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of Hamburg

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In Memoriam

ALBERS-SCHÖNBERG was a son of Hamburg. Through him Hamburg became Germany's metropolis for the roentgenologists of all the world and, during the first years of the growth of the roentgenology, the centre of the medical roentgenological science. At ALBERS-SCHÖNBERG's you could always be certain of meeting some one of the leading roentgenologists of Europe or of America, who had come to him, the master of the roentgen technique in order to get acquainted with the latest progress in the scope of roentgenology. Wherever you go in the world, on the European or American continent, you will see the faces brightening when the name of ALBERS-SCHÖNBERG is mentioned. No one contests him this high seat of honour within roentgenology, and all who have been fortunate enough to meet him are filled with reverence and admiration of his personality.

What then was the key of his success?

When ALBERS-SCHÖNBERG in 1897, then in the vigour of his manhood, felt his interest kindled by the newly discovered roentgen rays, and established a private medical roentgen institute, he had just completed a very many-sided medical training. After university studies in Tübingen and Leipzig, where he took his doctor's degree in 1891, ALBERS-SCHÖNBERG continued

his training in different clinics in Leipzig and Hamburg, for *gynecology, internal medicine, pediatrics and surgery*, and went for purposes of study to Berlin, Vienna and Paris. This rich general medical equipment was borne up by a personality of sterling quality: a mind devoted to study and research was united to a keen gift of criticism, an unyielding love of truth and a high practical intelligence.

Earlier than most of his contemporaries, ALBERS-SCHÖNBERG formed a clear idea of the importance of roentgenology for medicine. What made him the leader he so quickly became was, in the first place, his realizing that roentgenology, should it be scientifically pursued with success, must claim a man's entire work. He gave up his private practice, and looking neither right nor left he went straight towards the goal he aimed at: to build up roentgenology into a medical science.

Through his own devotion to his task he roused others to help in the work. Round him grew the staff of physicists, technicians and medical scientific collaborators who helped in the fruitful work which has emanated from the Hamburg school. The outward circumstances which placed him in a position to fulfil his endeavours was reached by ALBERS-SCHÖNBERG when in 1903 he was commissioned to set up, in St. George's Hospital in Hamburg, an institute for roentgen diagnostics and roentgen therapeutics, at which he was appointed as salaried specialist for roentgenology. In 1919 he was summoned to hold the first ordinary professorship of medical radiology in Germany, at the newly founded university of Hamburg. His grateful country conferred several rare distinctions on ALBERS-SCHÖNBERG, and foreign countries honoured him by electing him an honorary member or corresponding member of various medical societies.

ALBERS-SCHÖNBERG's main achievement is his fundamental work for the building up and developing of the roentgen technique, presented in his well-known *Text-book*, the fifth edition of which appeared in 1920. All over the world we find that ALBERS-SCHÖNBERG's work for roentgen technique has left its mark, especially his invention of the Diaphragm Compressor and

his screening technique, which has protected roentgenologists and patients from incalculable harm, though it was developed too late to save his own life. His discovery in 1903 of the effect of the roentgen rays on the genital glands is also of radical importance and has in an invaluable way likewise furthered the protective technique and the therapeutics based on roentgen castration.

Within most branches of roentgen therapeutics his conscientious research has opened up new roads. Especially in the medical field where he got his first special training, gynecology, he has achieved a pioneer's work as roentgenologist.

But ALBERS-SCHÖNBERG has perhaps wielded his greatest influence through the example which he has set by his roentgen institute and the work in it to the generations of roentgenologists who have studied there.

As the editor of the well-known journal »Fortschritte auf dem Gebiete der Röntgenstrahlen«, and of »Archiv und Atlas der normalen und pathologischen Anatomie in typischen Röntgenbildern«, both of which he has conducted in an admirable manner, ALBERS-SCHÖNBERG has made German roentgen research known all over the world.

He has himself published 150 works, of which his friend RUDOLPH GRASHEY has given a complete list in his necrology in the »Fortschritte«.

ALBERS-SCHÖNBERG died in his fifty-seventh year. After severe sufferings borne with an extraordinary fortitude, he succumbed to a cancrroid originating from roentgen sores on his hands, contracted during his earliest roentgen experiments.

The whole medical world is unanimous in honouring him as one of its foremost personalities.

The Scandinavian roentgenologists have a special reason and feel it a precious duty to pay their reverential homage and express their warm gratitude by the side of his bier. The roads of our studies have carried

us far and wide, and the Scandinavian roentgenologists have sought knowledge in all the chief centres of roentgenology in Europe and America. But ALBERS-SCHÖNBERG was as no other our great teacher during the years when the scientific study and the practice of medical roentgenology was founded in Scandinavia. His memory will live, honoured and revered, as long as the history of roentgenology lives.

Gösta Forssell.

On the Roentgen Diagnostics of Changes in the Appendix and Caecum

Introductory Address at the 2nd Congress of the Northern
Association for Medical Radiology in Copenhagen 1921

by

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(Figs. 1—42, Tabula IX—XIII)

The roentgen examination of the digestive canal may rightly be said to have attained a fairly high standard. Medical men are deeply conscious of its value and make an extensive use of same in order to complete the clinical examination with information respecting the anatomical and functional conditions, which the roentgen examination gives. The roentgenological diagnosis of the alimentary tract has, thanks to research work, developed from a modest beginning to ever greater perfection. Of late years we can mark great progress in diagnostics, namely, in regard to the ulcer duodeni. Another part of the same which seems to be of importance and to promise further conquests is the roentgen examination of the appendix.

I have for some time past been occupied with researches upon this matter at the initiative of Prof. G. FORSELL who has also been interested in this subject. It is true that my investigations are not yet concluded, but as I have had the honour at the Northern Radiological Congress to open up a discussion on this subject, I can only express the hope that the result of my investigations, together with the study of previous works in this branch, as here presented, may serve as a basis for discussion with respect to this subject.

I have to thank Prof. G. FORSELL for the keen interest he has shown in my investigations by giving me the opportunity in the roentgenological department at the Serafimer Hospital of examining the greater part

of my normal material and for handing over several cases to me which had been examined at his private roentgen institute.

In the following I shall mainly concern myself with the roentgenology of the appendix and shall treat caecum and ileum only so far as they are of interest in this connection. Such matters as tumours in caecum or ileocaecal tbc., I shall not discuss, as I consider that diagnostics in this branch has already been sufficiently gone into. Thus, if my lecture does not treat the whole of the subject under consideration, yet I trust through the limitation I have made to have caught its spirit.

The first to communicate the fact that he had observed appendix at a roentgen examination was BECLÈRE (1909). Subsequently many similar observations were published (AUBOURG, DESTERNES et BAUDON, LIERTZ, BÉLOT, CASE). The three first-named had observed appendix in about 5 % of the number of examinations. GRIGORJEFF made a communication at a congress in Moscow (1911) which excited attention. He had seen appendix fill and empty itself several times during the course of the examination and had seen it perform movements. He considered that appendix could always be seen at the roentgen examination, unless on account of anatomical conditions its lumen was shut off. He here met with opposition, among others from GROEDEL who, without the support of any considerable material, asserted that appendix only filled under pathological conditions with the opaque meal. COHN published somewhat later several observations respecting the movements proper to appendix, which, on the whole, agreed with GRIGORJEFF'S. The first more important works on the subject were published by GEORGE and GERBER (1913) and CASE (1914). GEORGE and GERBER directed special attention to the local changes of form in the appendix and to the changes in the distal portion of ileum in connection with appendix. CASE who based his authority on extensive material inclined to the same opinion as GROEDEL, namely, that appendix only filled under pathological conditions with the opaque meal and placed special importance on retention in appendix after the emptying of caecum as a pathological symptom.

Since this period a number of researchers have been engaged with the roentgenology of appendix. I may mention QUIMBY, HURET, IMBODEN, EISEN, GEORGE and LEONARD, PFAHLER, CARMAN and MILLER, FORSELL, BAETJER and FRIEDENWALD. An especially interesting contribution was given by SPRIGGS (1919) with a large number of operated cases and good reproductions. WATKINS and WARNER published in 1920 statistics on the pathological findings in one thousand roentgen ray examinations of the digestive tract with a big percentage of chronic appendicitis. In writing down this lecture I finally came across a little study on the subject by JUISSON.

My material consists of 110 patients whose appendix and ileocaecal tract I have examined, mainly in accordance with a method of examination which will be described below. 50 out of these patients have not had any clinical or subjective sign of affection whatever in the ileocaecal region or appendix and are calculated by me as normal material. The remaining 60 have, on the contrary, had symptoms which might have originated from the region mentioned. These are not all pathological cases, however, as a number of them have shown, on the other hand, as I shall further relate later on, absolutely normal conditions respecting appendix and caecum.

Of the material of appendix examinations, examined at Prof. FORSELL's private institute during recent years, which have been kindly placed at my disposal by him, one is included in the illustrative material here given (Case 7).

Examinatory technique

The technique at the roentgen examination of appendix, which plays an important rôle, is mentioned but casually in the majority of works on the subject. I therefore consider that there is reason to give an account of the process of examination, such as I have found to be suitable, in spite of the fact that a part of the same may be considered to be well-known or obvious by those who have occupied themselves with appendix examinations.

Examination after an opaque meal is the chief method of examination. As we know, appendix fills itself much more often with an opaque meal than with an enema. However, it is no rarity to see an appendix filled out on examination with enema, if one specially palpates after this. In one case it has happened that I have only been able to fill out appendix by an enema examination, due to the anatomical conditions (Case 3, figs. 7, 8).

As opaque meal I have employed for the majority of my examinations the barium sulphate meal, that has been used by FORSELL since 1907 in the roentgen department of the Serafimer Hospital, with observation of as thin a meal as possible being used. With about 200 gm. of water and 50 gm. of potato flour a thin gruel is boiled, and whilst it is warm it is stirred into 125 gm. of barium sulphate as finely distributed as possible. To this is added a mixture of about 200 gm. of water and red whortleberry juice and the whole well stirred together. This meal constitutes a well-distributed, non-sedimentary mixture of barium sulphate with a relatively fresh taste, which, as a rule, is tolerated very

well by the patients. In several cases I have tried the mixture warmly recommended by several authors (GEORGE and GERBER, SPRIGGS, etc.) consisting of barium sulphate in buttermilk, which is said to have a special capacity for forcing its way into appendix. At the comparative examinations which I have in some cases performed on the same patient with these various kinds of opaque meals I have not, however, found buttermilk gruel in any way superior to the above stated meal. As, moreover, buttermilk is generally difficult to procure just when wanted, I have found no reason to deviate from the easily prepared and relatively palatable meal which I also use for stomach- and duodenal examinations.

The patient should take a laxative the day before the examination, preferably castor oil, and diet frugally. On the day of examination he should neither eat nor drink anything before the opaque meal, but wait until four hours after the same.

As often as was possible I have examined not only caecum and appendix but also the stomach and duodenum. I consider it important to obtain a complete survey over the digestive canal, partly because the symptoms of a chronic appendicitis are many a time vague and sooner point to a ventricular affection, partly because certain reflex symptoms are sometimes to be found in the stomach, originating from the appendix, and, finally, because one should judge the emptying of the small intestine under guidance of the emptying of the stomach. Even as SPRIGGS, I have generally considered the emptying of the small intestine as normal, if the small intestine has been empty 4 hours after the stomach.

The first examination of caecum and appendix should be undertaken 6—7 hours after the meal. One ought preferably to examine at such a period of time as to ensure having the contents in the last ileum loop in order to be able to prove their relation to caecum and appendix.

One inconvenience is, however, if there are considerable contents found in ileum, especially if caecum is situated in the pelvis and caecum and the small intestine cannot be separated by palpation or compression. It may then be impossible to observe appendix. With normal caecal situation one may, however, often succeed and one can then obtain information of great importance, especially with respect to the formation of adhesions between the distal ileum loop and appendix or caecum.

The next examination should be made at that time that one reckons that the small intestine should be emptied, as a rule about 2 hours after the foregoing examination. Appendix is then most often filled, if it fills itself at the examination, or may be brought to fill itself at least partially by compression. By both these examinations one often obtains a good picture of appendix and information of importance respecting the peristalsis of appendix during the period of filling.

However, both these examinations, if difficulties are encountered in examining the patient several times during the first 24 hours, may be made together 7—8 hours after the meal. If at examination about 8 hours after the meal, whether with or without a foregoing 6 hours' examination, one has not been enabled to observe appendix filled out, it is advantageous to make a further examination during the first 24 hours, about 10 hours after the meal. It sometimes happens, namely, by an increased condition of contraction in appendix that one can only get a picture of the same during the first 24 hours, e. g. case 14. It is necessary, however, to individualize in every case in a suitable way, according to the idea one has got of the conditions at the first examination of appendix and caecum, even with respect to endeavouring to make the examination as little inconvenient for the patient as possible.

During the second day an examination is made about 24 hours after the meal and eventually a further one about 6 hours later. On the third day only one examination is made as a rule, about 48 hours after the meal. Caecum is then for the most part emptied. If appendix then contains any considerable residue, this can be observed during the next 24 hours. I generally consider it advisable, however, to make an examination 48 hours after the emptying of caecum. One does not gain much afterwards for the interpretation of the roentgen picture of appendix by continuing the examination for a longer period, if there should be any remains left in appendix. I shall further discuss this question later on when speaking of the emptying conditions of appendix.

In many cases it is advisable to close the examination with an enema examination. In order to determine if a caecum lying in the pelvis is fixed, an enema examination will prove of value, since caecum, when the pelvic portions of rectum and the sigmoid flexure are dilated from the enema, is, as a rule, displaced from out of the pelvis if it is mobile. The adhesions between caecum and the sigmoid flexure or rectum is also best observed at the enema examination. Existing remains of the opaque barium meal in caecum do not need to be removed by a purgative; the patient simply needs an ordinary enema previous to the opaque enema examination. In order to differentiate an irregularity in the contour of caecum, due to inflammatory changes, from tumour infiltrate, it may also be of importance to get a picture of caecum dilated by an enema (in such case the patient ought to take a laxative first). Whereas I do not consider that the verifying of the so-called incompetency in the ileocaecal valve at the enema examination — to which I shall return later on — has any diagnostic importance whatever.

The patient is examined at the examination after meal as well as at the examination with enema in recumbent position by trochoscope, as a rule

in supine position, sometimes in oblique-lateral position, sometimes in ventral position. I have had no use whatever of examinations in upright (standing) position, Trendelenburg's or full-lateral position with the tube from the back.

At examination by trochoscope in supine position it is most convenient to palpate the caecal region and the pelvis; caecum can best be displaced in recumbent position, so that appendix can be visualized, e. g. when it is situated retrocaecally; the displacement of caecum and appendix can well be estimated. Another important matter is that with the patient in recumbent position one has the best possibilities of compression, which is of importance in examinations of appendix, partly in order to be enabled to push caecum or ileum on one side from appendix, partly to get a clearer fluoroscopic picture and to be able to observe the peristalsis better in caecum and appendix.

A wooden spoon, that is introduced under the fluorescent screen is recommended by several authors, SPRIGGS among others, for palpation and fixation of the compression during the plate-taking. It appears to be the same as HOLZKNECHT mentioned for examinations of the stomach. It has, however, this drawback, namely, that the examiner must stand at the exposure in the neighbourhood of the trochoscope in order to fix the spoon in question and, furthermore, the fixation cannot be so good, e. g. at the serial exposure of 4 plates with 2 or 3 mins' interval between each, as if the fixation arrangement were made fast to the patient or table. For these examinations I have had an accessory apparatus made for FORSELL's trochoscopic table, to be screwed fast to this when it is to be used (fig. 1).¹ It allows of the fixation of the fluorescent screen and the lead plates for serial exposure together with cassettes in the position desired. Beneath the frame which supports the fluorescent screen, or the plate cassette, a compression sponge may be placed, which is fixed in its position by a placing of the frame in a suitable position, or else a compression sponge is used resting in a wooden ring through which is drawn a leather strap which is fastened round the patient and by self-fastening can be fixed in suitable tension by compression (fig. 2). The wooden ring in which the compression sponge rests can be shifted at pleasure on the strap laterally, whereby the compression can easily be applied at the proper place. With compression over the pelvis, this belt arrangement is, however, less to the purpose than a compression sponge placed under the frame supporting the fluorescent screen.

For serial exposure I use partly 4 exposures on a 24×30 cm. or 18×24 cm. plate, partly 2 exposures on 18×24 cm. and 13×18 cm.

¹ The apparatus is made from my model by Järnhs Elektriska A. B., Stockholm.

plates respectively, eventually doubled. The latter, since the tube does not occasionally stand 4 exposures in succession without either hardening or softening considerably, for which reason it is best to first make 2 exposures and after fresh fluoroscopy a further two. For 4 exposures on one plate I use that model which has been mentioned by ÅKERLUND in his duodenal paper. With 2 exposures beside one another on one plate one exposes first the half plate in a window in a leadplate of half the plate in size, afterwards projecting the cassette for exposure of the other half of the plate, thus the simplest possible arrangement. The leadplate for serial exposure is placed on the accessory apparatus as under the fluorescent screen, and is controlled during fluoroscopy, that the opening in the same may be just over that area to be photographed, and that the compression, if such is used, be suitably applied. After this the exposures are made, whereby the examiner can stand in the protection-cabine and thus avoid exposing himself to the roentgen rays.

The palpation of appendix and ileocaecal tract is always performed by me with the gloved hand. I consider that one obtains a better estimation of mobility, tenderness on pressure, resistance, etc. with the hand than by use of HOLZKNECHT'S distinctor and similar instruments. Massage over caecum, which was first recommended by GRIGORJEFF in order to fill out appendix, is not used by me to any extent, since, as a rule, one gains quite as much in this respect by suitably applied compression.

The variations in position of caecum

In many authors' works one sees statements respecting the position of caecum, namely, that it can vary considerably and be practically anywhere. In most cases, however, an anomaly in the position of caecum may be assigned to a certain fundamental type. The primary one is, as a rule, conditioned by the development, namely, an anomaly in the migration of caecum before it takes up its normal position in the right iliac fossa, or in its rotation or fixation. To this may come secondarily an abnormal fixation through formation of adhesions or a dislocation of a mobile caecum through some other cause.

The simplest form of anomaly in the position of caecum is a downward displacement of caecum in the lesser pelvis. This may partly be a partial symptom of a general enteroptosis, or may partly stand in connection with an abnormally long mesocaecum, which renders it possible for caecum to sink down into the lesser pelvis under the weight of faecal matter. Such a mobile caecum, if it is not fixed secondarily,

may often be pushed up by palpation into the iliac fossa. For this reason its mobility should be tested by an examination with enema as first mentioned in connection with examinatory technique. Whether such a caecum is pathological or not is a question on which opinions are divided. WILNES, who first asserted its pathological importance, has had several adherents, but has also met with opposition from authoritative quarters. One thing is certain and that is that one sometimes finds this anomaly without its exhibiting any particular symptoms.

A more severe form of what is generally called caecum mobile consists of a movable caecum — ascendens. This anomaly is due to a defective growing together between the visceral peritoneum on caecum and the ascending colon and the parietal peritoneum, and the formation of a mutual mesentry for the caecum and the ascending colon. The mobility of caecum varies according to the length of the mobile portion of the ascending colon and the length of the mutual mesentry. It can attain to a considerable degree of same as the following case shows.

Case 1: 62-year-old woman. Since the age of 20 has suffered from obstipation with evacuation of the bowels every 4th or 5th day. Has at times been better, sometimes worse. During the 3 weeks previous to examination she had fever and constipation alternating with diarrhoea.

On roentgen examination caecum was found 8 hours after the meal situated down in the lesser pelvis and was displaceable to a great extent. Its emptying was considerably delayed. An examination with enema ingestion (Fig. 3) best shows the mobility of caecum as it thereby arched up together with the nearest portion of the ascending colon along the descending colon. The lower pole of caecum, as is seen, reaches up to the transverse colon.

That such an anomaly will lead to stagnation in caecum with its consequences is easily explained. In many cases an intermittent torsion of the mobile caecum arises and gives the picture of an intestinal obstruction.

A missing fixation of caecum may also be connected with a missing descent of the colon. The migration of caecum during the developmental stage has then stopped at the hepatic flexure and the ascending colon does not develop. If thereby the fixation of caecum also fails, then caecum and the nearest portion of ileum fall down into the left iliac fossa. There hereby arises a purely left-sided position in the abdomen of colon and caecum. There is thus the possibility of a left-sided appendicitis as at the situs inversus of the abdominal organ.

The above-described anomalies in the position and mobility of caecum are, on the whole, those which exist on account of missing fixation of caecum and the ascending colon. Other anomalies in the position of caecum may depend on incomplete migration previous to the fixation.

It may stop at the hepatic flexure and when caecum is fixed here by a growing together of the peritoneal folds, then caecum will lie at the seat of the hepatic flexure whilst the hepatic flexure and the ascending colon are lacking. A suitable name for this position is that used by BROSCHE: *dystopia caeci superior congenita*. I will here relate such a case from my own observations. The picture is here somewhat modified by the patient's ptosis.

Case 2: A 35-year-old woman who had been troubled some years by diarrhoea, alternating with periods of obstipation and vague pains in the abdomen. On some occasions, the first time was 4 years ago, an attack of pain of short duration in the right side of the abdomen, which was interpreted as appendicitis. The clinical examination suggested colitis, in addition to which a small retention in the stomach was found.

On roentgen examination the stomach showed ptosis and somewhat reduced motility.

8 hours after the meal (Fig. 4) caecum was found situated with the lower pole upwards above crista iliaca on a level with the lower pole of the kidney, passing direct into the transverse colon which formed a curve down towards the lesser pelvis. Appendix hanging straight down along the medial side of caecum and the transverse colon. Caecum was fixed in its position, appendix likewise but slightly displaceable. After 24 hours (Fig. 5) caecum was emptied, the meal collected in the ascending portions of the transverse colon and rectum. Appendix still filled up in the same way. Fig. 6 shows serial plates of retention in appendix after 3 and 5 days. I shall later on have a few words to say about appendix in this case. On examination with enema it was found that colon was situated for the most part to the left of the medial line (Fig. 7) with a long lienal flexure. Only the right portions of the transverse colon and caecum were found in the right side of the abdomen.

I have had the opportunity of observing another similar case (40-year-old man) in which caecum lay somewhat higher and the transverse colon was developed in the ordinary way. This finding was quite incidental as the patient's symptoms of chronic ileus, such as roentgen examination showed, were caused by a tumour in the lower part of the sigmoid flexure. The passage through colon was, on account of this obstruction, delayed by several days and the stagnation extended to the small intestine also, which was not emptied after 24 hours. The ileocaecal orifice was even as in the foregoing case situated as usual on the left (medial) side of caecum showing that caecum had rotated in the usual way after the migration had ceased.

Other authors have described a delayed emptying of the small intestine with this anomaly of position in caecum. CONNELL has observed a kink with the same on the terminal ileum at the entrance of caecum, due to an incomplete rotation of caecum so that the ileocaecal orifice was situated backwards. Such a kink should explain the delayed emptying of the small intestine with this anomaly of position in several cases.

The high position of caecum is, however, in itself no cause of delayed emptying of the small intestine, as the first case here shows.

The migration of caecum may even stop at some place between the hepatic flexure and the iliac fossa. We then get a caecum situated high up, passing over into a short ascending colon. Fig. 8 shows a picture of this less remarkable anomaly which, as a rule, is not connected with any symptoms whatever.

In consequence of the fixation of caecum in abnormal position with mobile caecum — ascendens, various kinds of anomalies in the position of caecum may, finally, arise. A case with a more ordinary position of caecum is the following:

Case 3: 30-year-old man who had had colitis symptoms together with pains in the right side of the abdomen and was treated for intestinal catarrh. Had suffered considerable loss of flesh.

On roentgen examination the meal was found after 8 hours collected in caecum, the ascending colon and the nearest portion of the transverse colon, which together formed a curved loop in the right side of the abdomen with caecum situated upwards. An examination with enema gave a clearer picture of the relationship of caecum, appendix and the transverse colon to each other. Fig. 9 shows colon filled, with caecum turned up laterally towards the transverse colon. The hepatic flexure is situated above in the usual place. Fig. 10 shows a picture with compression between caecum and the ascending colon. Appendix situated above caecum, kinked in its distal portion, could not be displaced from the transverse colon. The diagnosis was made of a congenital mobile caecum, fixed upwards by the formation of adhesions. The operation confirmed this diagnosis. Appendix, which showed signs of chronic inflammation, was adherent to the transverse colon. Caecum was, besides, embedded in adhesions. After the loosening of these and appendectomy, caecum resumed its usual position in the iliac fossa. The patient's condition improved considerably after the operation.

In other cases, again, the dislocation of caecum with the formation of adhesions to neighbouring organs may be less pronounced, e. g. on fixation between caecum and the sigmoid flexure. Examination with enema gives, however, a distinct picture of the existing conditions.

A rare occurrence, which I once saw, is that caecum and the ascending colon were situated in an abdominal hernia quite laterally to and above os ileum outside the abdominal cavity.

How often is appendix visible at roentgen examination?

GRIGORJEFF already expressed the opinion in 1911 that appendix could be observed in all cases when it is not obliterated or the passage to the same obstructed in some way or other. He was probably

right, on the whole, in this respect. The earlier statistics certainly showed rather modest figures, but it can be proved that in later works the percentage of appendices observed at roentgen examination had risen considerably. This must quite certainly be ascribed to systematic examinations and improved examinatory technique. GEORGE and GERBER have given the figures since 1913 as 7 to 10. Among authors from later years e. g. SPRIGGS, JUISSON, etc. the percentage keeps at about 80.

My own appendix material embraces 110 cases examined by myself, mainly in accordance with the technique which has been described above. I divide these into two series. The one embraces 50 patients who neither with respect to their histories nor clinically have shown the slightest sign of disease in appendix or its surroundings. The greater part of these patients, whom I had examined at Serafimer Hospital, were ulcer patients that I had examined in connection with examinations of the stomach, most of them had received no catharsis. In this series I have seen appendix filled in practically 50 % of the cases. This series is, however, of greatest interest for the enlightenment of the question as to if appendix fills normally at the roentgen examination. In the second series, which embraces 60 patients whose symptoms might have been interpreted as possibly depending on appendix, I have been enabled to observe appendix in 46 cases, thus in rather more than 75 %. In the greater majority of those cases in which appendix has not been observed, caecum has been situated in the lesser pelvis and has not been able to be shifted up manually into the iliac fossa; in two or three cases a stenosis in the proximal portion of appendix has been found due to obliteration or kinking, in one case retrocaecal and for the most part retroperitoneal position of appendix with acute inflammatory changes.

In order to aid in solving the question as to why appendix never fills with faecal contents, which is of importance to find out, among other things for the diagnosis of those cases in which appendix is not visible at roentgen examination, I have had an examination of corpse material made at the pathological department of the Caroline Institute. I owe a debt of gratitude to Professor T. HELLMANN and Doctor Börje for their help in this examination. Unfortunately, it is only on autopsy material that it is possible to study the anatomical conditions at the appendical orifice, as the proximal part of appendix with the orifice is invaginated, as a rule, at operation. The ileocaecal valve, to which some ascribe a certain importance, can also be observed only from the inside of caecum.

The material embraces 42 appendices from ordinary autopsy material without special choice. In most of the histories there is nothing which suggests a past appendicitis. In spite of this, appendix has shown

pathological changes in about 40 % of the cases, if, among these, obliterations, distal or total, are reckoned. If these are deducted, which by RIBBERT are reckoned as a physiological process, about 25 % show macroscopic-pathological changes such as adhesions, stenoses, kinks, etc. Out of these 42 appendices there were 12 = 29 %, lacking faecal contents. The half of these were totally obliterated, most of these obliterated ones were found in old persons over 50 years of age. Two of the remaining appendices which lacked faecal contents lay retrocaecally and in the one of these there were mucous membrane hemorrhages found besides. The other four cases showed a well-developed GERLACH's valve or strong mucous membrane folds towards caecum, which on cutting, however, were completely straightened. However, in several of the appendices which were filled with loose faeces there was found a well-developed valve, for which reason this does not seem to play any great rôle with respect to the filling of appendix. This is also the opinion of the majority of the pathologic-anatomical authors.

It may be of interest by way of comparison to adduce ASCHOFF's statistics on the occurrence of faecal contents in appendix, built on a large and carefully examined operative material.

Of 52 normal appendices 32 = 62 %, contained faeces, 3 = 6 %, contained faecal concretions.

Of 177 pathological but not acutely inflamed appendices 110 = 62 %, contained faeces and 22 = 12 %, faecal concretions.

Of 126 acutely inflamed appendices, faeces were found in 12 = 10 %, and faecal concretions in 34 = 27 %.

The normal and pathological but not acutely inflamed appendices thus contained faecal contents in about the same percentage, whilst the acutely inflamed contained faeces but in a small percentage whereas on the contrary, faecal concretions in a relatively high percentage.

Through these series of examinations which are built on a microscopically carefully examined material one may consider the opinions of OBERNDORFER and many others as confuted, namely, that a normal appendix does not fill with faecal contents. OBERNDORFER has certainly found in about 50 % of the examined appendices »brown contents», but on very weak grounds he considers that these are not faecal. He thus advances as support to his opinion that the appendix can never be observed at the roentgen examination — the work dates from 1906 — and that the brown contents in a turned up appendix cannot very well be faecal, since it would be difficult for such contents to force their way in on account of the kinking of appendix at its base. Our present experience of roentgen examination of the appendix, however, completely confutes both these points. Appendix may, on careful observation, be

observed in 70—80 % of the cases and a turned up appendix is not infrequently seen filled, which shows that it is far from always being kinked at its base. His other reasons are not more convincing. I have dwelt on this question because OBERNDORFER's views seem to have played a certain rôle in the roentgenology of the appendix and have been cited by many roentgenological authors.

The normal roentgen picture of the appendix

One usually comes across the appendix at roentgen examination at the medial side of caecum where it issues from the lower pole of the same. It is often turned down towards the lesser pelvis situated between the terminal ileum and caecum; sometimes it lies more horizontally, crossing the terminal ileum at the back side. A not infrequent position is the subcaecal one, immediately below caecum in the iliac fossa or in the lesser pelvis. Further, appendix can be turned up medially or laterally to caecum. The former is not unusual if caecum is situated in the lesser pelvis (Fig. 11), but also occurs at the usual position of caecum, which I have seen in 2 or 3 cases, that at operation had been found free from adhesions. The mesenterium is then usually short. The laterally turned up position is more unusual. Finally, appendix can be situated retrocaecally, usually turned up. If appendix is long, the distal portion may be situated behind the ascending colon.

The form of appendix, such as one sees it at roentgen examination, can vary considerably. The most usual seems to be the comma-form or a faint S-shaped curve. Long appendices have usually small angulations, turned up ones are, however, often fairly straight, sometimes with an angulation in the distal portion. A spiral-shaped or curled up appendix is not unusual in subcaecal position, if it is rather long (Fig. 12). Such an appendix can, as a rule, be straightened out completely by palpation or compression (Fig. 13).

The average length of the appendix shadow on the normal appendices I have examined has been about 5 cm. with considerable variations. The longest measured 11 cm. The width of lumen has varied between 2—4.5 mm. GEORGE and LEONARD, and CASE have noted that in health the shadows may vary in width from $\frac{1}{4}$ in. down to a thread or a row of dots. OBERNDORFER has seen a long, completely normal appendix in an old man with a lumen, the width of a little finger, filled with faecal contents. A generally wide lumen in an appendix cannot thus be credited with any pathological importance. Within the same appendix the lumen in my material has not varied in width by more than a few

mm. The distal end is often rather wider than the rest of appendix. During different conditions of contraction the width of lumen varies, however, considerably.

As we know, caecum begins to fill out about 3—4 hours after the meal and appendix sometimes shows a slight filling at the same period of time. However, it does not fill mechanically by the contents running into the same from caecum, but the contractions of appendix and even caecum play a great rôle in the filling of appendix. After 6—8 hours caecum and the ascending colon are, as a rule, well filled and appendix is then also often filled. Many times one must use compression above caecum to get appendix fairly well filled. One can then see that the contents are pressed in in the proximal portion of appendix when this dilates now and again, at the same time as peristaltic waves are seen in caecum in the neighbourhood of the appendical orifice, directed towards this latter. Now and again the proximal portion of appendix contracts and the contents are then forced forwards in appendix, possibly also partially back towards caecum. Even as SPRIGGS, I have only observed this peristalsis during the filling period of appendix, it might appropriately be called the filling peristalsis. Sometimes it is more, sometimes less pronounced under normal conditions.

For the rest, there occur more or less deep haustral contractions in caecum and in the filled parts between these relatively superficial wave-like contractions which may take their course in oral as well as distal direction. On the whole, the peristalsis of caecum thus agrees with that of colon.

In some cases with very quick intestinal and colonic passage I have observed retrograde transport of the meal in the transverse colon and also that caecum and appendix during influence herefrom have filled more completely. CASE and SHALIN consider that such a retrograde transport is due to antiperistalsis which may occur in the colon even without intestinal obstruction existing. Figs. 14 and 15 show the influence of this retrograde transport in the colon on the filling of caecum and appendix together with the influence of the continued emptying of the intestine.

During the 2nd day the appendix is, as a rule, if it can be observed at the examination, well filled and shows no movements worth mentioning at fluoroscopy. On serial plates taken at a few minutes' interval, slight wave-movements may be observed, however. There are, besides, wave-like contractions of varying width to be found here and there, entirely or partially closing up the lumen of the appendix. These annular contractions move, as a rule, but very slowly, so that often during fluoroscopy and on serial exposures with a few minutes' interval

one cannot see any distinct progression of the same. However, sometimes, especially on palpation of appendix, one can observe that portions of the appendix hastily contract and segment the appendix, whereby the contents are driven towards caecum. During the influence of catharsis these annular contractions show a considerable augmentation of strength and can divide up the whole of the appendical lumen into small segments (Fig. 6). They probably play the chief part in the expulsion of the contents out into the caecum.

A normal appendix of moderate length empties, as a rule, 1—2 days after the caecum, i. e. after the chief mass of the meal has been expelled out of caecum. At the appendical opening small remains are often found in caecum during the emptying of appendix, which, in all probability, consist of contents which have been expelled out of the appendix. If appendix is unusually long, without showing any pathological changes at operation, it may have a retention of contents up to 5 days after the emptying of caecum, such as I have seen in one case. CASE who ascribes great importance to retention in the appendix has found in »poorly drained» appendices scar formations in the musculature, etc. after past inflammatory processes, which he considers explain why appendix empties slowly. He further considers, just as many others do, that such a »poorly drained» appendix is dangerous. My experience, on the contrary, points in the direction of one being unable to ascribe any special importance to retention in the appendix as a pathological phenomenon, if it is not localised to a certain area in the appendix, caused by a stenosis, kink, etc. As to the danger of a »poorly drained» appendix, I consider that one lacks sufficient experience to be able to express any opinion hereon. That one or another such case has sickened with acute appendicitis some time after the roentgen examination proves nothing concerning the great majority of such appendices.

The roentgen picture of the pathological appendix

With respect to the roentgen examination of the appendix, some authors have expressed the opinion that it is only in some few cases possible to determine the position of appendix and to ascertain as to whether the tenderness coincides with the appendix. SINGER and HOLZKNECHT go still farther and maintain that one has gone the wrong way to work in endeavouring to observe the appendix itself and to draw conclusions from the roentgen picture of the same. They recommend instead an exact localisation of the tender places with a so-called distictor indicated by them and a transmission of the same straight away onto the fluoroscopic

picture of the caecum, colon and the small intestine. Now-a-days this opinion rather gives one the impression of being antiquated. To make a roentgen diagnosis in the case of a gastro-intestinal complaint simply on the basis of the localisation of tenderness on pressure would not be considered justifiable by anyone from the present standpoint of roentgen diagnostics. It is just the observation of the changes in the form of the appendix, the motility, mobility, etc., which have advanced roentgen diagnostics within this particular branch. This has been fully demonstrated by some of the works on the subject, especially those of later date which I mentioned in the introduction. The scope of the roentgen examination of the appendix is mainly restricted to the chronic appendicitis and its sequelae. For various reasons there is, as a rule, no question of examining acute appendicitis. Firstly, time does not usually allow of an examination which extends over more than a couple of days and, secondly, it is not possible or advisable to palpate or use compression in the ordinary way in order to be able to observe the appendix.

Those changes we are acquainted with from pathological anatomy, which may be of importance for the roentgen picture, are chiefly stenoses or obliterations in the lumen of the appendix, kinks, etc., caused by the formation of adhesions or changes in the mesenterium, the fixation of the appendix to neighbouring organs and the occurrence of faecal concretions. Hereto may be added changes in the motility of the appendix such as hyperperistalsis, spasm or diminished capacity for emptying and the observation of tenderness localised in relation to the appendix.

My material comprises a number of 26 operated cases which have been operated on the roentgenological diagnosis of chronic appendicitis or the remains of such in the form of adhesions. In 22 of these cases the diagnosis has been confirmed. In 4 cases no macroscopical changes have been found in the appendix, for which reason the appendix has not been considered to be able to give any explanation to the picture of disease. In most of these latter cases the roentgen diagnosis has been made principally on the basis of tenderness over the appendix and considerable delay in the emptying of the same. In all of the 26 cases excepting one the appendix was visible at the roentgen examination.

As has been previously emphasized, the form of the appendix can vary very much under different conditions of contraction and one must have observed a constant change of form during the course of examination in order to be able to draw conclusions as to the existence of a stenosis in the lumen, kink or other change of form. I consider, how-

ever, that the local changes of form in the appendix are of great importance when it concerns the determination of as to whether the appendix is pathological or not.

1. Stenoses in the appendix

After an attack of appendicitis there is sometimes a scar left in the appendical wall as remains of the same, causing a more or less severe stenosis in the lumen of the appendix. This is an unfavourable moment, as hereby infectious material may be retained distally to the stenosis and occasion renewed attacks. If appendical secretion stagnates distally to the stenosis, then the meal cannot enter this part of the appendix at the roentgen examination. The roentgen picture, therefore, shows a short, hasty narrowing of the appendical lumen, if the stenosis is situated in the proximal portion of the appendix. Distal stenoses are, on the contrary, more difficult to establish if the meal has not entered in distally to the stenosis in any considerable quantity. Among my operated cases there are 4 in which the examination has shown an obstruction in the proximal half of the appendix (together with other changes). In 2 of the cases a stenosis in the appendical wall was found, in the 2 others the narrowing was caused by a complete kinking through the formation of adhesions.

Case 4: 40-year-old man who had had vague abdominal trouble for about a year, discomfort immediately after meals, sometimes pains in the right side, spreading out towards the back. The patient had consulted a prominent surgeon shortly before my having examined him, who declared that there was no question of any appendical trouble. He was sent for examination on the suspicion of gall-stones or duodenal ulcer.

On roentgen examination the stomach showed a certain degree of hypertonia and hyperperistalsis but otherwise the finding was negative with regard to the stomach, duodenum and gallbladder. On examination 7 $\frac{1}{2}$ hours after the meal, remains were found in the terminal ileum which lay close up to the medial side of the caecum (Fig. 16). The proximal portion of the appendix was filled like a little plug between the caecum and the ileum. The terminal ileum could be displaced but slightly from caecum (Fig. 17). No kink or stenosis was, however, found in the ileum loop. The serial pictures show different phases of contraction in the ileum and the ileo caecal valve.

10 hours after the meal (Fig. 18) the ileum was emptied. The appendix was now observed on compression to be more filled than before, but showed a peculiar form with a narrow, upward curved lumen, resembling a fish-hook.

Caecum was well displaceable and together with it the appendix and the terminal ileum also. The patient noted no great tenderness over the appendix but only a certain feeling of discomfort on pressure over the same. After 24 hours the appendix was emptied and the caecum partially so.

The roentgen diagnosis was made of a chronic appendicitis with stenosis in the appendical lumen about 1 cm. from the orifice and a fixation of the terminal ileum through the formation of adhesions. On operation this diagnosis was completely confirmed. The distal portion of the appendix was swollen and red about 1 cm. from the base of the appendix, an adhesion was found between the appendix and the terminal ileum.

Case 5: 26-year-old woman. Since the age of 14 had had stomach trouble and pains in the right side of the abdomen besides now and again. Has dieted carefully and has been free from symptoms for some years, but the last 2 years she has been worse again. She has recently been treated by a stomach specialist with ulcus cure, has kept careful diet since this but the trouble has not been alleviated.

There was nothing of a clinical nature worthy of remark other than tenderness in the middle of the epigastric tract and the right iliac fossa.

On roentgen examination the caecum was found rather wide, hanging down over the innominate line in the lesser pelvis and fixed in this position. (Fig. 19). Through compression over caecum one could fill the proximal portion of the appendix which was turned upwards for about 1 cm. in length. No further filling of the appendix was obtained during the examination. The patient was tender to touch over the medial portion of the caecum and the appendix. The emptying of the caecum was somewhat delayed. The stomach and duodenum showed no changes.

The roentgen diagnosis was made of a fixation of the caecum through adhesions and a stenosis in the proximal portion of the appendical lumen, in all probability a chronic appendicitis. On operation the caecum was found hanging down in the lesser pelvis, fixed in its position through firm adhesions between the caecum and the posterior abdominal wall. These adhesions surrounded the appendix also and had kinked it in the proximal portion corresponding to the roentgen picture. The appendix was 8 cm. long, as thick as a lobworm. The coating of the wall was firm and somewhat thicker than is normally the case. The mucous membrane inflamed, swollen mainly in proximal direction to the kink. The adhesions were loosened, the appendix was extirpated and caecoplication was performed.

In a third case (Case 6) which showed clinical symptoms of an acute attack of appendicitis in decline, the proximal portion of the appendix only filled as a funnel-shaped recess at the lower pole of the caecum. A minimal amount of the barium meal passed besides in the distal portion of the appendix. The patient was markedly tender immediately below the filled portion of the appendix. The emptying of the small intestine was considerably delayed, in spite of the fact that no kink or stenosis in the ileum could be proved.

A stenosis was found on operation after the foregoing attack of appendicitis in the proximal portion of the appendix. A couple of small ulcerations in the mucous membrane were found in the distal portion, which only contained an insignificant quantity of secretion, together with a small polypus-resembling formation.

2. Kinks and adhesions

If the appendical lumen is not stenosed on account of kinks and the appendix is quite filled, then one gets a good picture of the site of the kink as in the following case:

Case 7: 35-year-old man. Has had symptoms of colitis and vague pains in the abdomen now and again.

Roentgen examination showed an appendical shadow about 10 cm. long with the distal portion down in the lesser pelvis, kinked in a pointed angle. The proximal portion of the appendix was for some distance quite contracted (Fig. 20). Pronounced tenderness over this area. Fig. 21 shows retention after 24 hours at the site of the kink. Even 5 days after the emptying of the caecum a retention was found in the distal portion of the appendix.

On operation a chronic appendicitis with the appendix kinked and fixed in the lesser pelvis, containing in addition a faecal stone.

Another operated case with a less pronounced kink in the proximal portion is shown by fig. 22.

A picture resembling a kink in the distal portion of the appendix is shown by fig. 23. This change of form was, however, not constant during the examination. The patient felt marked tenderness over the appendix and retention in the same after the emptying of the caecum. On operation the appendix showed no pronounced changes.

I have in one case seen a turned up appendix rectangularly kinked in two places. On operation the kinks were shown to be due to adhesions.

It is of importance to be able to establish the existence of adhesions to the appendix or the caecum, as hereby many symptoms of vague pains are explained. Concerning the appendix one must, however, take regard to the fact that its mobility is relatively limited if the mesentericolum is short. In addition to the foregoing I will here further record a few cases of adhesions.

Case 8: 57-year-old woman. Stomach trouble for some years, nausea after food and obstipation of long duration. Nothing clinically worthy of remark other than a slight tenderness in the lower portion of the right iliac fossa.

On roentgen examination the stomach showed ptosis, otherwise nothing remarkable. 8 hours after the meal the food filled the caecum situated in the lesser pelvis the ascending and the transverse colon, besides which remains were found in the small intestine nearest the caecum (Fig. 24). The appendix was partially filled on the medial side of the caecum situated along the superior straight and fixed. The caecum could not be displaced from its position either. On palpation over the appendix it partially emptied itself very quickly. The transverse colon had sunk downwards, its descending shank could not be displaced from the caecum to any considerable degree. After 24 hours (Fig. 25) the central portion of the transverse colon was heavily filled and it had sunk still more. The tip of the fixed appendix was seen immediately over the transverse colon.

The roentgen diagnosis was made of a fixation of the caecum and the appendix and probably also pericolic adhesions (Jackson's membrane), in accordance with the description of its roentgenological symptoms as given by GEORGE and GERBER.

On operation it was found that from the anterior surface of the caecum a membrane extended over the abdominal wall, which had to be divided in order to get into a free abdominal cavity. The proximal $\frac{1}{3}$ was the seat of a chronic perito-

nitis, the central portion almost overbridged by adhesions. The mucous membrane of the appendix showed no visible changes to the eye when cut.

Case 9: 35-year-old woman. During the last month has had an attack of pain in the right side of the abdomen, now in the upper now in the lower portion. On a visit to the hospital nothing clinically objective was found with exception of tenderness in the right side of the abdomen with uncertain localisation.

An examination of the stomach showed a long stomach with ordinary motility. 8 hours after the meal this latter was collected in the caecum and the ascending colon; the caecum, situated in the lesser pelvis could not be displaced up into the iliac fossa (Fig. 26). After 2 days the appendix was best visible when the ascending colon had partially emptied. It was turned up along the innominate line on the lateral side of the caecum, the contents segmented, the proximal portion — as is often the case with an upturned position — incompletely filled. It was but very slightly displaceable and tender. On operation a chronic appendicitis was found with moderate adhesions around the appendix.

3. Hyperperistalsis, spasm

The peristalsis which under normal conditions can sometimes be observed in the appendix, especially its proximal portion, and the caecum in its neighbourhood during the filling period of the appendix can sometimes be considerably augmented and assume the character of hyperperistalsis or a complete spasmodic contraction of a greater or lesser portion of the appendix.

Case 10: Figs. 28 and 29 refer to a case of chronic appendicitis with somewhat thickened appendical wall and a faecal concretion at the end. The pictures show an increased, somewhat varying condition of contraction in the proximal portion of the appendix, a wide lumen in the distal portion and an indistinct filling at the end which is curved upwards. Besides which small contractions in caecum in the neighbourhood of the appendix are seen.

Figs. 30 and 31 (Case 11) show a still more pronounced hyperperistalsis in the proximal portion of the appendix and contractions in the caecum in its neighbourhood. The contractions almost strangulated the appendical lumen sometimes. The patient was distinctly tender over the appendix. Fig. 31 shows how mobile the distal portion of the appendix is, as on palpation it could be extended out from the lower pole of the caecum.

Figs. 32 and 33 (Case 12) refer to a 19-year-old girl with periodic pains in the right side of abdomen, especially on bodily exertion. The caecum was situated down in the lesser pelvis (Fig. 30) but could be displaced up into the iliac fossa. On compression over the caecum in this position (Fig. 32) the appendix was at once observed filled, turned up straight, long with relatively narrow lumen and thin filling. On palpation the appendix emptied at once; it was extremely tender to touch. The appendix could not afterwards be observed during the examination in spite of the fact that the patient after 24 hours got another meal of barium sulphate and butter-milk. The wall of the appendix was in this case thickened all over; the mucous membrane showed signs of an acute stage of the process at some places.

Case 13: 20-year-old woman with periodic attacks of pain in the abdomen which lasted 2 or 3 days, combined with diarrhoea. Clinically there was only tenderness on pressure to the right of the navel, the clinical diagnosis was chronic appendicitis.

Fig. 34 shows the appendix filled 30 hours after the meal with a relatively thin filling and a somewhat denser marginal zone. During the first 24 hours it was observed that the appendix was not noticeably filled, probably on account of spasm. On operation a long and thickened appendix was found; on being cut the mucous membrane was shown to be considerably thickened and studded with small ulcerations.

4. Faecal concretions, faecal lumps and foreign bodies in the appendix

In the roentgen literature there are many, for the most part casuistic communications concerning the concretions in the appendix, observed at roentgen examination. It has mostly been a question of a small calculus shadow which might have been taken for an ureter stone. Roux has written a big work on the subject with a casuistic of 62 faecal stones among 1037 extirpated appendices, of these 9 were roentgenized. This was, however, as early as in 1913 and therefore not very much is to be gleaned from the roentgen picture of concretions in the appendix.

It is but seldom that one meets with lime incrustated concretions. Usually they consist of an organic mass, a mixture of intestinal contents and products of the mucous membrane of the appendix. Such concretions do not actually give any shadow on the plate, but they can be observed in the appendix if this latter is filled with barium meal, in the form of sharply limited, light gaps. If the barium meal is collected on the one side only of a concretion, such as is often the case if it lies at the tip of the appendix or obstructs the passage of the meal through a narrowed lumen, then one gets a more or less sharply limited, rounded defect in the barium shadow from the one side of them only.

SPRIGGS states »that the lumen proximal to an old concretion is often bent into a sharp hook. A hook-shaped end to the appendical shadow should suggest the possibility of a concretion». Figs. 28 & 29 (Case 10) show such a picture. I have also observed such a sharp bending, although not as a constant deformity, in the proximal portion of the appendix in a fine case of appendical concretions in which almost the whole appendix was filled by a row of such.

Case 14: 45-year-old man who for some time past had had attacks of pain in the right iliac fossa, during a few weeks' visit to the hospital he had a subfebrile tem-

perature besides now and again. Clinically nothing worthy of remark with exception of tenderness in the iliac fossa.

Figs. 35 & 36 are serial pictures of the caecum and appendix 7 $\frac{1}{2}$ hours after the meal. In fig. 35 the appendix lies horizontally on the medial side of caecum. Its proximal portion, which is narrow, is curved in a sharp hook upwards, distally to this there is a row of light gaps in the appendical shadow. In the picture in the lower left corner four such are seen and the suggestion of a fifth in the end. Fig. 36, which is taken 15 mins. later, shows quite another picture of the appendix. It now lies straight down along the medial side of caecum and shows no pronounced gaps in the filling. It could not be brought by palpation or compression to assume its former horizontal position. The difference in the pictures, as both are taken with compression, can, well, scarcely be explained otherwise than that the appendical wall in the one case is more firmly contracted round the concretions, for which reason they are distinctly accentuated as light gaps.

Fig. 37, 24 hours after the meal shows remains of barium round a concretion in the proximal portion of the appendix. In the lower portion of the caecum there is a peculiar deep contraction, almost entirely stagnating the lower portion of the caecum. I cannot interpret this other than as an abnormal spasm. I have only in one case more observed such a one, namely, in a case of chronic appendicitis with a stenosis in the appendical lumen (Case 4, fig. 18) and a collection of secretion distal to the stenosis, thus an obstruction to the emptying of the appendix. I hold it probable that through such a spasmodic reflex action attacks of pain may be caused, whereby the picture of disease in this case of concretion is explained.

The roentgen diagnosis was made of a row of concretions in the appendix, which was confirmed beyond all expectations as a row of 7 concretions were found in the appendix, whilst the barium meal had only reached to the fifth. Between the concretions which lay close up to the mucous membrane, narrow bands of brown, tough, partially faecal contents were found in agreement with the roentgen picture.

Figs. 38 & 39 show a case of 2 calciferous concretions at the end of the appendix. On the first one the appendix after 7 hours has not yet filled up as far as them, but on the second one, on the contrary, taken 24 hours later. After the emptying of the appendix and caecum the shadows remained unchanged.

As we know, many different kinds of foreign bodies may collect in the appendix. SPRIGGS shows pictures of a case of 2 shot of minor calibre in the appendix, which had been swallowed. After 3 weeks the appendix had succeeded in emptying the shot.

The light gaps in the appendical shadow besides being of real concrement may, of course, consist of firm faecal particles with which the meal does not mix. Fig. 40 is such a case. The appendical wall was thickened and in the end of the appendix there was found a firm faecal lump together with an obliteration for the most part distal. Besides which there was a stringy adhesion between the lower surface of caecum and appendix which could not be proved by examination.

5. Tenderness on pressure and reflex symptoms in the stomach

Tenderness on pressure, distinctly localised to the appendix or caecum, is a valuable symptom of an inflammatory process and it may be said that it is through roentgen examination alone that it is possible to localise tenderness in relation to these organs. At roentgen examination we see, namely, constant variations in the position of the appendix and caecum. But even as with regard to tenderness at ulcer, one must be cautious in interpreting this subjective symptom. With an existing inflammatory process tenderness may be but slightly pronounced, whilst sometimes tenderness can be found over the appendix without any inflammatory changes being proved at operation, as I have seen in some cases. Tenderness can never therefore be the main support for the diagnosis, and only in connection with changes of form in the appendix, adhesions or signs of spasm, etc. is it of any diagnostic value.

In some cases of chronic appendicitis I have observed that the patient has had eructation when I have used compression over the appendix. This has taken place quite automatically as if one had pressed a button. This can only be explained as a reflex symptom from the stomach, and this latter showed also in these cases an irregular, periodically reinforced peristalsis and relatively long periods of pyloric contractions. I have not observed any other contractions in the gastric peristalsis which might be interpreted as reflex symptoms from the appendix, thus never any actual pyloro-spasm with gastric retention nor any filling defect in the duodenal cap either, which BAETJER & FRIENDENWALD have described. If one sees such, one must, well, suspect a local change in the duodenum, unless one has had the opportunity of convincing oneself of the non-existence of such from a resection preparation.

6. Inflammatory changes in the caecum in appendicitis

A perityphlitic infiltrate in connection with an acute appendicitis may show a picture resembling ileocaecal tbc. or tumour, as will be shown by the following case:

Case 15: 21-year-old woman. For two years pains on and off in the intestinal tract. Has been ill now for the past 4 days with pain all over the abdomen and nausea. The pains have gradually moved downwards to the right side. The temp. 37.3, tenderness in the right iliac fossa.

At the roentgen examination after the meal a large 8-hours retention was found in the small intestine in the lesser pelvis. Caecum was incompletely filled, whilst the upper portion of the ascending colon was better filled. After 24 hours (Fig. 40)

the small intestine was emptied. In the upper portion of the caecum and lower portion of the ascending colon a constant filling defect was found, whilst the lower portion of caecum and the ascending colon were well filled above the defect. The nearest portions of the caecum and the ascending colon were quite fixed, a resistance was palpated in this tract. The appendix was not visible. At the examination with enema (Fig 41) the area of the defect partially filled with the enema, but only small, strongly contracted lumen with ragged contours was visible in this area. The roentgen diagnosis of an infiltrate in the walls of the caecum and the ascending colon was made, probably tbc. On operation immediately after the examination a turned up appendix was found with its distal end, which was kinked, situated behind the upper portion of the caecum. In this portion of the appendix a perforation was found, the whole having the appearance of an ordinary acute appendicitis. The upper portion of caecum and the nearest portion of the ascending colon had a strongly infiltrated wall with the typical appearance of an inflammatory infiltrate, corresponding to the visible defect at the roentgen examination. The mucous membrane of the appendix was acutely swollen, the appendix contained secretion only, no barium.

That the infiltrate in this case was localised to the upper portion of the caecum and the nearest portion of the ascending colon may be explained by the fact that the perforation in the appendix, in consequence of its upturned position, lay high up. The roentgen picture reminds one very much of ileocaecal tbc. with exception that the process had left the lower portion of the caecum completely in tact.

Such an inflammatory infiltrate may disappear without leaving a trace. With healed perityphlitic processes and adhesions the contour of caecum is, however, sometimes uneven and jagged in the area of the same.

The incompetency of the ileocaecal valve

CASE first made the observation that on examination with enema the ileum fills in many cases to a greater or lesser extent through the enema. GROEDEL who had made similar observations ascribed pathological importance to this so-called incompetency in the ileocaecal valve and considered that it was caused especially by perityphlitic changes. CASE considered that through incompetency in the valve a stasis was caused in the ileum, which in many cases with examination after meal could be proved and on account of the stasis in the ileum obstipation arose among other symptoms. The opinions as to the pathological importance of the symptoms mentioned have, later, however, been very divided.

KELLOGG who co-operated with CASE has had an opportunity during operation to examine the ileocaecal function after a roentgen examination in which the valve had been found to be incompetent. He has found

»that a division or stretching of the muscular band that passes just behind the ileocolic junction, the habenula, causes an unfolding of the intestine and more or less disappearance of the haustra contiguous to the ileocolic junction and damage to the ileocolic valve, which may be rendered partially or completely incompetent. If the peritoneal and outer muscular coats are stretched or divided at the ileocolic junction, the ileum may be pulled out of the large gut and the valves disappear, leaving a large, funnel-shaped opening instead of a button-hole opening guarded by overlapping lips».

According to my experience, the proving of incompetency of the ileocaecal valve by examination with enema does not play any noticeable part as a pathological symptom. I have very carefully examined the intestinal passage in several cases with incompetent valve by aid of an examination with enema and have only in one case seen an insignificant quantity which had probably passed from the caecum back again to the ileum. I have seen incompetency in the ileocaecal valve at an examination with enema in about every 4th case, many times in patients who have not had any symptoms whatever from the ileocaecal tract and who have not even had symptoms of obstipation, which CASE considers that incompetency leads to and which SCHWARTZ considers to be the cause of incompetency. In several cases, with incompetent valve at examination with enema, which have been operated for some other reason, the caecum has not shown any kind of inflammatory changes or adhesions. In other cases, again, in which caecum at operation had shown such, the valve at examination with enema had been competent. From this and from KELLOGGS above-referred-to experiences it is plain that we cannot, as GROEDEL maintains, in any way interpret the incompetency in the ileocaecal valve as a symptom pointing to perityphlitic processes, etc. It seems to me to be quite clear that we can, generally speaking, only speak of an actual incompetency in the ileocaecal valve if we observe a retrograde passage from caecum to ileum after an opaque meal. This is, namely, the only test which shows how the valve functions during the passage of food. The examination with enema puts the valve under quite different conditions than the physiological, even if the pressure on ingestion is kept low.

I thus consider, in contradistinction to SCHWARTZ, that one must confirm the incompetency not only by examination with enema but also after an opaque meal in order to be able to speak of a real incompetency. That a stagnation in ileum may be caused by a stenosis in the valve just as well as by incompetency places no limitation in this respect. The main object is, generally speaking, to ascertain first and foremost in every case if the remains of the meal are to be found in the ileum

longer than what is normal. One has besides the possibility of roentgenologically proving a stenosis in the ileocaecal valve (GEORGE & GERBER).

The good results which KELLOGG has obtained with his method of repairing the ileocaecal valve certainly goes to prove that the incompetency, where it really exists, may be of pathological importance. But I consider it my duty to point out that, according to my experiences, the symptom of incompetency of the ileocaecal valve, verified at the examination with enema, in all probability lacks pathological importance and in any case cannot be interpreted as a symptom of inflammatory processes in connection with chronic appendicitis.

Summary

1) The roentgen examination of the appendix and the ileocaecal region, carefully performed, may give information of great value.

2) A normal appendix can be proved at the roentgen examination just as well as a pathological one.

3) The pathologic-anatomical changes in chronic appendicitis are of several different kinds and the roentgen picture is therefore not uniform either, but shows different combinations of anatomical and functional changes. The changes found ought to be interpreted with due regard to the patient's picture of disease.

4) In the interpretation of the roentgen picture of the appendix one should attach special importance to pronounced changes in the form of the appendix such as stenoses and kinks together with adhesions. Hereto may be added as pathological symptoms spasm, hypermotility and tenderness on pressure. Retention in the appendix after the emptying of the caecum should, on the contrary, only with extreme caution be interpreted as a pathological symptom.

5) Incompetency in the ileocaecal valve, established by examination with enema, is of no value as a symptom of changes due to chronic appendicitis and probably not as a pathological symptom at all.

Literature

The greater part of the roentgenological papers about appendix and caecum are to be found in the references of

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Index to figures of Tabula IX

Fig. 1. Apparatus, to be attached to the trochoscope table, for fixation of the fluorescent screen, cassettes and leaden plates for serial exposures.

Fig. 2. Girdle for compression. In the wooden ring is placed a loofah sponge and the girdle is placed on the patient.

Fig. 3. Caecum mobile. Enema. Caecum at left along colon descendens.

Fig. 4. Dystopia caeci superior. 8-hour plate. Caecum (b), appendix (a).

Fig. 5. Same case, 24-hour-plate. In caecum and transverse colon only remainders of the meal. Appendix (a) well filled.

Fig. 6. Serial exposures of the emptying of same appendix, the uppermost pair after three days (three minutes interval between the exposures), the lower after 5 days and laxative. Remainder in appendix (a and a'), in caecum (b). Calcified gland (c).

Fig. 7. Same case. Enema. Caecum (b), appendix (a). Calcified gland (c). Transverse colon long, the middle part ptotic, directly entering into caecum, whose lower pole lies upward.

Fig. 8. 8-hour plate. Short ascending colon, due to arrested migration of caecum, which is above the crista iliaca.

Index to figures of Tabula X

Fig. 9. Enema. Caecum mobile (a), fixed upwards by adhesions.

Fig. 10. Same case, enema with compression of caecum. Appendix (a) filled, kinked in distal part and adherent to transversum (b).

Fig. 11. 8-hour plate. Normal appendix, directed upwards from caecum, which is in the pelvis. The tip (a') somewhat wide and best filled. Proximal part (a) did not fill without compression of caecum.

Fig. 12. $7\frac{1}{2}$ -hour plate. Normal appendix (a), subcaecal, coiled. Caecum (c), terminal ileum (b). (Operated.)

Fig. 13. Same case at same time, with compression, before palpation. Appendix (a) straightened. Remainder in terminal ileum (b).

Fig. 14. $4\frac{1}{2}$ -hour-exposures (two minutes interval). Caecum (b) constricted, hausted just as ascending colon. Various constriction phases of terminal ileum. The tip of appendix in completely filled (a).

Fig. 15. Same case, 7-hour-exposures. Owing to retrograde movements in the transverse colon and emptying of ileum, caecum and appendix are well filled. Funnel-shaped basal portion of appendix (b), proximal part partly constricted (a). Terminal ileum (c).

Fig. 16. 7-hour exposures (two minutes interval). Terminal ileum lies close to caecum, between both appendix (a).

Index to figures of Tabula XI

Fig. 17. Same case as Fig. 16. Serial exposures (with compression). Terminal ileum cannot be separated from appendix, which is filled only as a tip (a). Various peristaltic waves on terminal ileum.

Fig. 18. Same case, 10-hour-plate, serial exposures (double two). The lumen of appendix short, fisk-hook-like, only the base has normal width (stenosis). Deep constriction, passing through the lower part of caecum.

Fig. 19. 8-hour-plate (with compression). Caecum hanging down in the pelvis, fixed. Appendical shadow short (obstruction, due to adhesions).

Fig. 20. 8-hour plate. Appendix long (10 cm), partly in the pelvis, distal part kinked and adherent, proximal part constricted.

Fig. 21. Same case. 24-hour-plate. Remainder in the distal part of appendix (remained for 4 days after the caecum was empty.)

Fig. 22. 8-hour plate. Appendix slightly kinked at the base (a), the lumen narrow.

Fig. 23. 8-hour plate. Subcaecal appendix with simulated kinking in the distal part (bc) (not permanent during the examination). At (a) constriction by moderate filling peristalsis.

Fig. 24. 8-hour plate. Caecum in the pelvis, fixed by adhesions. Appendix (a) adherent and kinked in the distal part. Terminal ileum (b), transverse colon (c).

Fig. 25. Same case. 24-hour plate. Transverse colon (c) in the middle part strongly filled, the tip of appendix above transversum. Caecum (b) partly empty.

Index to figures of Tabula XII

Fig. 26. 8-hour plate. Caecum (b) in the pelvis, appendix (a) partly filled.

Fig. 27. Same case, 48-hour plate. Appendix (a) best visible after ascending colon is empty, lies upwards at the outer side of caecum, fixed by adhesions. Proximal part incompletely filled.

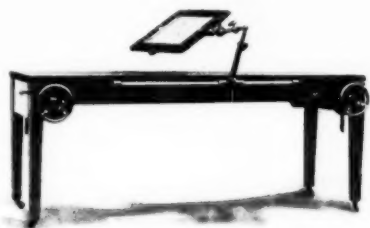


Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.



Fig. 5.

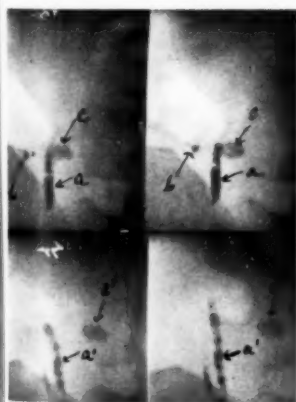


Fig. 6.



Fig. 7.



Fig. 8.





Fig. 9.

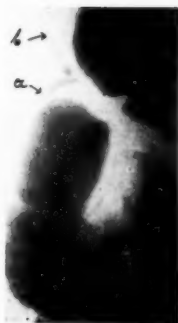


Fig. 10.

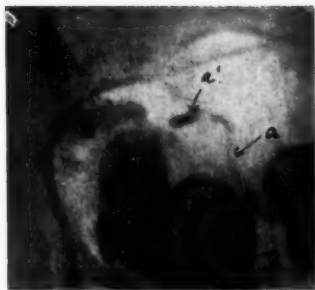


Fig. 11.



Fig. 12.



Fig. 13.

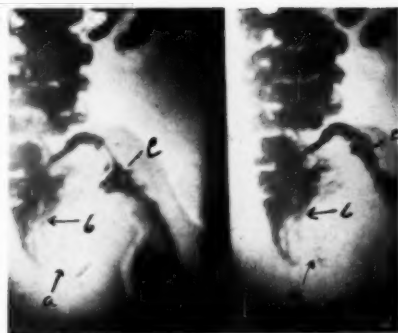


Fig. 14.

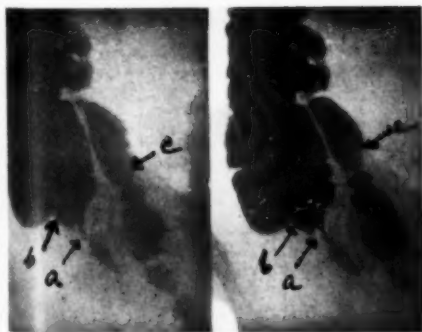


Fig. 15.

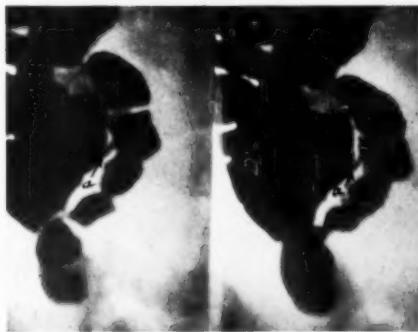


Fig. 16.

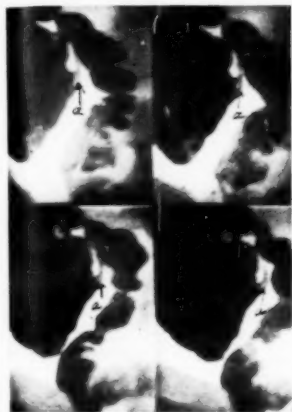


Fig. 17.

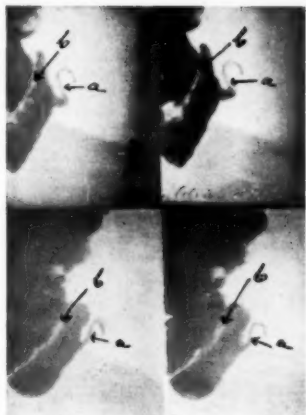


Fig. 18.



Fig. 19.



Fig. 20.



Fig. 21.



Fig. 22.



Fig. 23.

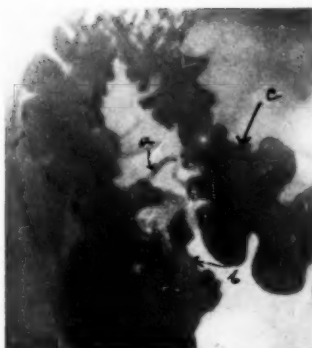


Fig. 24.



Fig. 25.



Fig. 26.



Fig. 27.



Fig. 28.

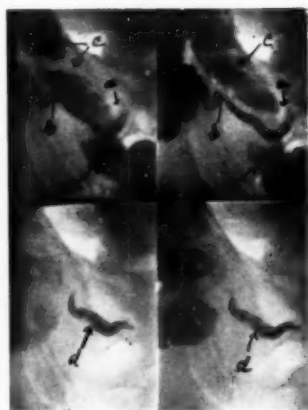


Fig. 29.



Fig. 30.

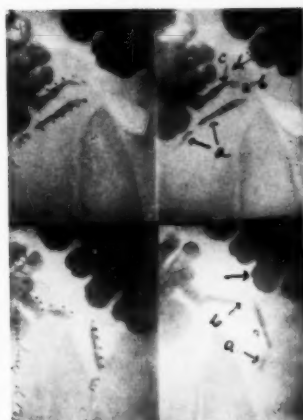


Fig. 31.



Fig. 32.



Fig. 33.

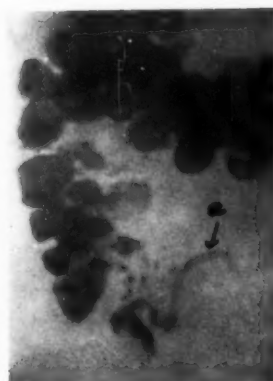


Fig. 34.



Fig. 35.



Fig. 36.

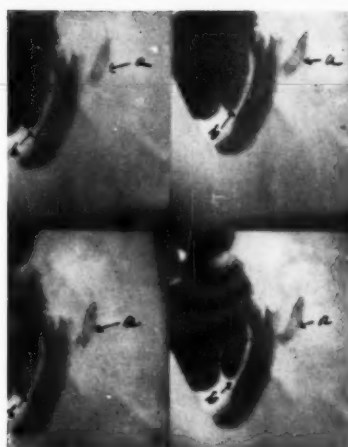


Fig. 37.



Fig. 38.



Fig. 39.



Fig. 40.



Fig. 41.



Fig. 42.

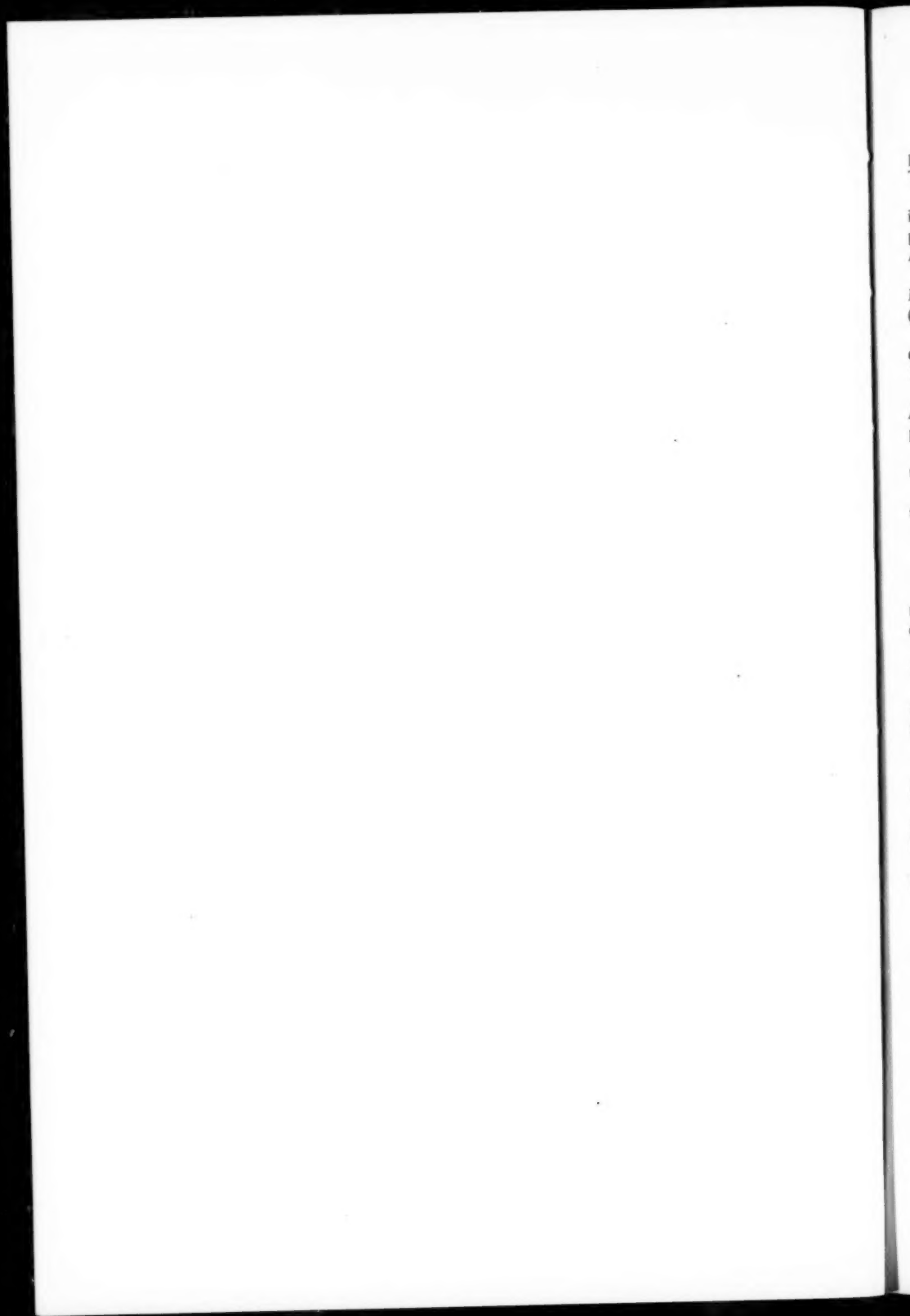


Fig. 28. 7-hour plate. Appendix wide in the distal part (a), irregularly filled, proximal part narrow (b). Small peristaltic waves on caecum around appendix. Terminal ileum (c).

Fig. 29. Same case. *Uppermost pair:* 7-hours plate (exposures with 1 minute interval). Proximal part of appendix narrow and hooked (b). Moderate filling peristalsis. Distal part hooked upwards and irregularly filled (a). Terminal ileum (c). *Lower pair:* Appendix 24 hour later.

Fig. 30. $7\frac{1}{2}$ -hour plate, serial exposures (double two) with two minutes interval. Marked hyperperistalsis with vigorous constrictions in the proximal part of appendix (a) and the base (b). Peristaltic waves on caecum around appendix.

Fig. 31. Same case. 48-hours plates. *The uppermost pair:* Distal part of appendix (a) lies subcaecal, close to caecum. At (b) emptying constriction. Transversum (d). *The lower pair:* Distal part of appendix straightened after palpation.

Fig. 32. 8-hour plate with compression. Caecum forced up from the pelvis. Appendix (b) lies upwards, long, with narrow lumen. The base funnel-shaped. By palpation appendix emptied itself at once.

Fig. 33. Same case, following day after new opaque med. Caecum in the pelvis, wide. Appendix was not visible.

Fig. 34. 30-hour plate. Appendix (a) lies upwards on the medial side, the shadow densest along the borders.

Index to figures of Tabula XIII

Fig. 35. $7\frac{1}{2}$ hour exposures. Appendix (a) horizontal, sharply hooked and narrow in proximal part. Within the appendical shadow a suite of vacuoles (concretions).

Fig. 36. Same case, 15 min. later. Appendix hanging along caecum, the vacuoles not marked. Slightly undulatory motions on the appendix.

Fig. 37. Same case. 24-hour serial exposures (2 minutes interval). Only proximal part of appendix filled round a concretion (a). Through the lower part of caecum a deep constriction (b).

Fig. 38. 7-hour plate. Caecum (b), concretions in appendix (a), terminal ileum (c).

Fig. 39. Same case, 24 hour later. Appendix and concretions (a). Caecum (b) partly empty.

Fig. 40. 8-hour plate. Hard faecal mass in the tip of appendix (a). The appendical shadow in proximal and middle part narrow and irregular. Terminal ileum (b).

Fig. 41. 24-hour plate. Filling defect in the upper caecum and lower ascends (due to perityphlitis).

Fig. 42. Same case. Enema.



Pericarditis Calculosa und Herzverkalkungen

von

T. Klason, M. L., Stockholm

(Tabula XIV)

Das Vorkommen von Pericardverkalkungen war seit langem bekannt gewesen. Die Diagnose dieser seltenen und eigenartigen Erkrankung zu Lebzeiten des Patienten war jedoch vor Einführung der Röntgendiagnostik in die klinische Medizin nicht möglich.

So sagt DIEMER 1899 in einer Arbeit über die Pericardverkalkungen, dass eine Durchleuchtung mit »Kathoden-Strahlen«, die man damals in der Herzdiagnostik anzuwenden begann, vielleicht zur Stellung der Diagnose bei Lebzeiten beitragen könnte (1). LYDTIN erklärt 8 Jahre später, dass die Röntgenmethode die einzige Methode ist, die zu Lebzeiten Aufschlüsse über Verkalkungen des Pericards geben könne (2). Diese beiden Verfasser haben, gestützt auf Obductionsmaterial, mehr im Vorbeigehen auf den Wert hingewiesen, den eine Röntgendurchleuchtung in ausgesprochenen Fällen haben müsse.

Der Erste, der vom röntgenologischen Standpunkt näher auf die Frage eingeht, ist SIMMONDS (3). Er teilt die Verkalkungen am Herzen nach ihrer Lage in drei Gruppen, nämlich Verkalkungen am Myocard, Endocard und Pericard. Verkalkungen am Endo- und Myocard sind, wie bekannt, sehr gewöhnlich; sie kommen nahezu bei jedem älteren Individuum vor. Sie entwickeln sich aber niemals so stark, dass sie mit unserer derzeitigen Technik zu Lebzeiten hätten nachgewiesen werden können. Ganz anders verhält es sich mit den Pericardverkalkungen. Diese können eine solche Mächtigkeit erreichen, dass sie nach SIMMONDS bei einer gewöhnlichen röntgenologischen Durchleuchtung sichtbar werden müssen. Sehr bald zeigte es sich, dass SIMMONDS' Annahme richtig war, denn einige Jahre später, 1910, teilte SCHWARZ den ersten Fall mit, in dem die Diagnose Pericardverkalkung bei Lebzeiten gestellt worden war (4). Bei einer aus anderem Anlass vorgenommenen Durchleuchtung des

Thorax bei einem Patienten sah er im Herzschatten eine Anzahl dichter, pulsierender Schatten. Der grösste hatte ein Ausmass von 3×2 cm, und lag links im Herzschatten, am oberen Teil des linken Kammerbogens.

Der Patient hatte keine Symptome seitens des Herzens, hatte aber vor mehreren Jahren einen heftigen Schlag in die Herzgegend bekommen. Ein Jahr später teilte derselbe Autor noch einen Fall mit. Es handelte sich um einen 33 jährigen Patienten mit vergrösserter Leber und Ascites, aber ohne Ödem an den unteren Extremitäten. Bei Durchleuchtung des Thorax wurde ein dunkler, fingerbreiter, pulsierender Streifen entdeckt, der von der Herzspitze der unteren Grenze des Herzschattens bis über die Mittellinie folgte.

F. M. GROEDEL publicierte 1911 einen Fall, in welchem die Diagnose Pericardverkalkung, dank einer Röntgendurchleuchtung, zu Lebzeiten gestellt werden konnte (5). Die Verkalkung lag in diesem Fall gleichfalls im linken Teil des Herzschattens an der Grenze zwischen linkem Vorhof und Kammer. RIEDER bringt zwei Fälle, von denen der erste, von MILLER ausführlich beschriebene, mehrmals durchleuchtet worden war; aber erst bei der dritten Durchleuchtung wurden im Herzschatten einige dichte, pulsierende Schatten entdeckt (6, 7). Ein Jahr nach der Entdeckung dieses Befundes wurde eine Aufnahme gemacht, bei welcher auf der Platte ein dichter Schatten zu sehen war, der von der Grenze zwischen linker Kammer und Vorhof längs der linken Herzgrenze rund um die Spitze verlaufend, fast bis zur Mittellinie ging. Von diesem dichteren griffen dünnere Schatten auf das nächst benachbarte Gebiet des Herzens über, und bildeten hier ein Netzwerk. Bei seitlicher Aufnahme zeigte es sich, dass die Verkalkung auf der Vorder- und Unterseite des Herzens liege. Seine Rückfläche war vollständig frei. Im zweiten Fall sah man auf der Platte dünne Kalkstriche an der linken Kammerkantur, die sich eine kurze Strecke auf den unmittelbar benachbarten Teil des Herzens fortsetzten. WEIL berichtete kürzlich über einen Patienten, der das klinische Bild einer pericarditischen Pseudolebercirrhose (PICK) aufwies (8). Die Verkalkung war bei der Durchleuchtung gut zu sehen, und bildete eine Schale um den Ventrikelteil des Herzens, welche die Spitze frei liess.

Auch BRAUER teilt in GROEDEL'S »Röntgendiagnostik in der inneren Medizin« einen Fall mit so auch ASSMANN in seinem Handbuch.

Von pathologisch anatomischer Seite sind Pericardverkalkungen wohl bekannt und oft beschrieben. Häufig haben die Patienten zu Lebzeiten Symptome von Pericardsynechien, Pericarditis externa, pericarditischer Pseudolebercirrhose oder multipler Hyaloseritis aufgewiesen. In anderen Fällen sollen in vivo keinerlei Symptome seitens des Herzens vorhanden gewesen sein. LUCAS, LYDTIN, DIEMER, OBERNDORFER u. a. haben eine grosse Zahl von Fällen beider Art beschrieben 1, 2, 9, 10. Stets sassen

die Verkalkungen in Pericardsynechien. Es ist also klar, dass sie sich sekundär nach einer Pericarditis mit Verwachsung beider Blätter des Pericards entwickelt hatten.

Die Symptome von Pericardsynechien sind oft sehr undeutlich und unbestimmt. In vielen Fällen kann man bei der Obduction ganz ausgedehnte Pericardsynechien finden, ohne dass sich in vivo die geringsten Anzeichen gezeigt hätten, die auf ein Herzleiden deuten. In anderen Fällen fanden sich bei Lebzeiten die bekannten systolischen Einziehungen über der Präcordialgegend, charakteristische Änderungen des Thoraxprofils bei Ex- und Inspirium, (WENCKEBACH) Pulsus paradoxus, inspiratorisches Anschwellen der Halsvenen, u. s. w. Zu diesen Symptomen gesellten sich in einer grossen Zahl von Fällen mancherlei Zeichen einer gestörten Circulation, vor allem eine eigentümliche Verteilung der Stauung mit Stauungsleber und Ascites, aber nur unbedeutendem Ödem an Beinen und Füssen. Also nahezu das Bild einer Stauung im Portakreislauf (12). Diese eigentümliche Verteilung der Stauung soll zum Teil darauf beruhen, dass der Portakreislauf für die geringste Störung in der Herztätigkeit besonders empfindlich ist, besonders wenn die Diastole des rechten Herzens durch Synechien erschwert ist. Nach anderen soll eine Pericardsynechie in allen Fällen von einer adhäsiven Pleuritis um die rechte Lungenbasis gefolgt sein (13). Die Adhärenzen an dieser Stelle sollen die günstige Einwirkung der Diaphragmabewegungen auf die Portacirculation erschweren. Es scheint mir aber, als ob da noch Vieles klarzustellen wäre, besonders da sich zu einer adhäsiven Pericarditis häufig eine Pericarditis externa gesellt.

Nach neueren pathologisch anatomischen Untersuchungen, die auf ein verhältnismässig grosses Material aufgebaut sind, scheint es, als ob die Pericardverkalkungen nicht an beliebigen Stellen des Pericards abgelagert würden, sondern bestimmte Prädispositionsstellen hätten. Nach MÜLLER werden sie stets zuerst am rechten Ventrikel am Übergange zwischen Facies sternocostalis und diaphragmatica, und erst später am Rand des linken Ventrikels am Übergang zum Vorhof abgelagert (14). RIEDER nahm an, dass sie sich an diesem Platz zuerst abgelagerten (6).

Die genannten Stellen sind in der nächsten Nachbarschaft des Sulcus coronarius gelegen. Bei einer sero-fibrinösen oder fibrinösen Pericarditis, diesen Verkalkungen vorgehend, sammeln sich die Fibrinmassen in der grössten Menge dort an, wo die Herzbewegungen am geringsten sind. Eine solche Stelle ist gerade das Gebiet längs des Sulcus coronarius. Durch reaktives Granulationsgewebe wird die Gewebscirculation zu den Fibrinmassen gehemmt, und wenn sie nicht resorbiert werden, können sie hier lange Zeit abgeschlossen liegen bleiben. Solche tote Massen, in denen die Gewebscirculation verlangsamt ist, haben eine ausgesprochene Neigung zur Verkalkung. Die Lage der Verkalkungen im Pericard ist

somit durch die Herzbewegungen selbst bedingt, und der Kalk lagert sich gerade dort ab, wo die Herzbewegungen am schwächsten sind. Das erklärt auch, dass sie oft so geringe Symptome einer Störung der Herztätigkeit geben, und kein specielles, klinisches Symptom hervorrufen, das auch bei einer Pericardialsynechie ohne Kalkeinlagerung abwesend sein kann.

Betreffs der primären Ätiologie ist kein gesetzmässiges Verhalten zu konstatieren. Es ist klar, dass man ein chronisch wirkendes Virus annehmen muss. In vielen Fällen hat man Tuberkulose als primäre Ursache feststellen können. In anderen Fällen konnten bei der Section keine Zeichen einer Tuberkulose nachgewiesen werden. Man hat dann an ein chronisch oder subchronisch wirkendes Virus anderer Art gedacht, wie Streptokokkus viridans, der auch nachgewiesen worden war.

Von manchen Seiten ist hervorgehoben worden, dass die Herzbewegungen eine vollkommene Konsolidierung des Kalkes hindern sollten. Kleine Sprünge im Panzer sollten die Herzbewegungen ermöglichen. Dass es sich nicht immer so verhält, beweist einer der Fälle DIEMERS. Das Herz war unmittelbar unter dem Sulcus coronarius von einem vollständigen Kalkring umgeben, der so massiv war, dass er ein Mazerationspräparat von demselben machen konnte. Dieser massive Kalkring war am breitesten, 8.5 cm, an der Unterseite des rechten Ventrikels, und am schmalsten am linken Teil des Herzens am Übergange zwischen Vorhof und Kammer. Mit dem Myocard war er fest verwachsen. In diesem Fall traten Herzsymptome erst $1\frac{1}{2}$ Jahre vor dem Tode auf, und man kann sich gut vorstellen, dass der Ring sich um diese Zeit zu schliessen begann. Der Fall ist auch insoferne interessant, als der Process lokal so umschrieben war, dass das Pericard unterhalb dieses Kalkrings normal und ohne Verwachsungen war.

Einer meiner Fälle (Fall III) ist bis zu einem gewissen Grade mit dem Diemer'schen analog, mit einem massiven Kalkring rund um den Ventrikelteil des Herzens nächst dem Sulcus coronarius.

Ich verfüge über vier Fälle dieser seltenen Erkrankung und ein Fall mit Verkalkung in Annulus fibrosus. In den drei ersten wurde die Diagnose erst bei der Section am hiesigen pathologisch-anatomischen Institut gestellt, in den letzten beiden Fällen konnte die Diagnose Herzverkalkung, dank die Röntgenuntersuchung zu Lebzeiten gestellt werden.

Fall I. Obduktion 66. 1897. Herz eines alten Mannes, gestorben an Cardio-Arteriosclerose. Abgesehen von dieser Erkrankung, deren Symptome sich während seiner letzten Lebensjahre entwickelten, hatte er nie Zeichen einer Herzkrankheit gezeigt. Bei der Obduktion fand man eine vollständige Pericardialsynechie mit zwischengelagerten Kalkmassen. Auf der Facies diaphragmatica des Herzens, vom Sulcus coronarius bis hinunter zur Spitze reichend, findet sich eine massive Kalkplatte. Von dieser geht ein Netzwerk von Kalkstreifen aus, die den Ventrikelteil des Herzens decken, mit Freilassung der Spitze. Die Verkalkung greift etwas auf die Vorderseite

des rechten Vorhofs über, und auf den Conus pulmonalis. Irgend welche auf Tuberkulose deutende Zeichen konnten bei der Sektion nicht nachgewiesen werden.

Fall II. 83 jähriger Mann. Klinische Diagnose: Dementia senilis + cardio-arteriosclerosis + hämorrhagia cerebri. Bei der Sektion (Obduktion 312, 1913) fand man eine vollständige Pericardsynechie mit in derselben eingelagerten Kalkplatten. Die grösste Kalkplatte liegt beim Sulcus coronarius auf dem rechten Ventrikel, am Übergange zwischen Vorder- und Unterseite des Herzens. Längs des Sulcus coronarius finden sich ausserdem auf dem Ventrikelteil des Herzens einige kleinere Kalkstreifen.

Bei der Obduktion fand man ferner eine vorgeschrittene Cardio-arteriosclerosis, eine Splenitis subchronica mit Perisplenitis, sowie eine pericarditische Pseudolebercirrhose. An einer Lungenspitze auch Zeichen einer alten Tuberkulose.

Fall III. Seraphimer Krankenhaus, IV medizinische Abteilung. 1915. A. T., Mann, 38 Jahre alt. Klinische Diagnose. Picks Symptomenkomplex.

Aus der Krankengeschichte möge angeführt werden: Keine Heredität für Tuberkulose. Als Kind hatte er geschwollene Drüsen am Hals, die jedoch, ohne Hinterlassung von Resten, vollständig zurückgingen. Seit seinem 15 Jahre hatte er ab und zu ein Druckgefühl über der Herzgegend. Etwas später kam auch Druck und Unbehagen in der Lebergegend hinzu. 1914 steigerten sich die Beschwerden, er wurde müde und kurzatmig, und der Bauch schwoll an. Einige Zeit war er in Spitalsbehandlung und sein Zustand besserte sich erheblich. Einige Zeit danach kamen jedoch die Beschwerden zurück, des Abends waren jetzt seine Beine oft in der Gegend um die Fussknöchel geschwollen. Aufnahme in das Krankenhaus am 11. 10. 1915. Hatte bei der Aufnahme eine vergrösserte Leber und Ascites, sowie systolische Einziehungen über der Präcordialgegend, und war leicht cyanotisch an den Lippen. Die Herztöne waren etwas dumpf, aber ohne Geräusche. Das Herz nicht nennenswert vergrössert, der Blutdruck 115 mm Hg. Kein Icterus.

Über den Lungen an einzelnen Stellen lockere Rasselgeräusche, und beiderseits hinten an der Basis eine leichte Dämpfung. Wassermanns Reaktion im Blute negativ. Am 4. 11. wurde Brauers Cardiolyseoperation vorgenommen, mit Resektion des sternalen Endes der 4--6 Rippe auf der linken Seite, samt den Knorpeln. Nach vorübergehender Besserung der subjektiven Symptome steigerte sich die Kurzatmigkeit, die Leber und die Beine schwellen an, und unter zunehmender Atemnot und Cyanose starb der Patient am 23. 11.

Bei der Obduktion fand man den Herzbeutel durch schwartiges Bindegewebe mit der vorderen Thoraxwand verwachsen: Die beiden Blätter des Herzbeutels waren bis auf ein kleines Gebiet auf der Vorderseite des Herzens vollständig miteinander verwachsen. In den Pericardsynechien fand sich eingelagerter Kalk. Die Vorhöfe waren erweitert, die Ventrikel aber waren von normaler Weite und Dicke, und die Klappen, abgesehen von einer Erweiterung der Valvula tricuspidalis normal. Ferner konstatierte man eine Stauungsleber, vollständige Pleura-synechie auf der linken Seite und Infarkte in den Lungen.

Die Verteilung des Kalkes innerhalb des Pericardiums tritt auf einem Röntgenbild des herausgenommenen Herzens deutlich hervor. Der Kalk bildet einen breiten Ring, der den Ventrikelteil des Herzens unterhalb des Sulcus coronarius umfasst. Von diesem breiten Ring geht ein schmalerer Fortsatz längs des Margo acutus nach unten. (Tab. XIV fig. 3).

Unmittelbar vor der Operation war eine Röntgenuntersuchung des Thorax vorgenommen worden. Es war eine Andeutung von triangulärer Herzform vorhanden, seine Konturen waren verwischt und die einzelnen Kammern waren nicht mit der gewöhnlichen Deutlichkeit zu unterscheiden. Die Pulsationen waren klein, der Hers-Leber-Winkel spitzig. Die Breitenmasse des Herzschatens im Orthodiagramm waren links 8.5, rechts 6 cm., der Gefässchaten 6 cm in der Breite. Pleuro-pericardiale Adhärenzen waren nicht nachzuweisen. Als Resultat der Untersuchung muss man sagen, dass die dreieckige Form des Herzens, mit den verwischten Konturen und den schwachen Pulsationen, sowie die Schwierigkeit, die einzelnen Kammern zu unterscheiden, in hohem Grade für eine adhäsive Pericarditis spricht.

Der grosse Kalkring rings um das Herz wurde aber überhaupt nicht bemerkt, weder bei der Durchleuchtung noch auf der Platte. Erst bei der jetzt vorgenommenen Nachprüfung der Röntgenplatte sieht man einen ungemein dünnen Schatten, der parallel und etwas nach innen von der linken Kammerkontur verläuft. Die Platte ist mit einer sehr weichen Röhre aufgenommen, etwaige andere Details innerhalb des Herzschatens sind nicht zu sehen.

Fall IV. A. L. 60 Jahre, Frau. 1919. Seit 15 Jahren hatte sie Anfälle von »Asthma«, bekam leicht Atemnot, und hatte mitunter geschwollene Beine. Seit ungefähr einem Jahr vor der Röntgenuntersuchung hatte sie anhaltende Schmerzen in der Magen-grube und ab und zu Erbrechen. Der Stuhl war bisweilen schwarz gefärbt. Am Herzen: Die Töne an der Spitze deutlicher als an der Basis, keine Nebengeräusche, der erste Ton an der Spitze accentuiert. Keine percutorische Vergrößerung des Herzens. Abdomen: Empfindlichkeit im Epigastrium, die Leber ist palpabel, empfindlich und hart. Kein Icterus, kein Ascites.

Die Pat. wird vom Maria Krankenhaus, Stockholm, zur Untersuchung von Herz und Magen in das Röntgeninstitut gesandt. Eine Veränderung am Magen konnte bei der Röntgenuntersuchung nicht festgestellt werden. Der Befund am Herzen ergab ein Breitenmass von 4.5 resp. 8 cm nach rechts, bzw. links von der Mittellinie. Die linke Kammerkontur pulsierte stark, der Aortaschaten war in ihrer Breite etwas vergrößert, dicht, und pulsierte stark. Das Herz verschob sich bei der Atmung nur sehr wenig. Innerhalb des Herzschatens sah man eine eigentümliche, kalk-dichte Figur, welche kammersystolische Pulsationen zeigte. Ihre grösste Masse hatte sie auf der Unterseite des Herzens, unmittelbar rechts von der Mittellinie. Bei Durchleuchtung in schiefen Richtungen und bei rein seitlichen Bildern konnte die Centralmasse am Übergang zwischen der Vorder- und Unterseite des Herzens lokalisiert werden. Von dieser centralen Partie schickt sie kleinere Fortsätze die Vorderseite des Herzens hinauf, bis nahe zu seiner rechten Grenze. Grössere Fortsätze verlaufen

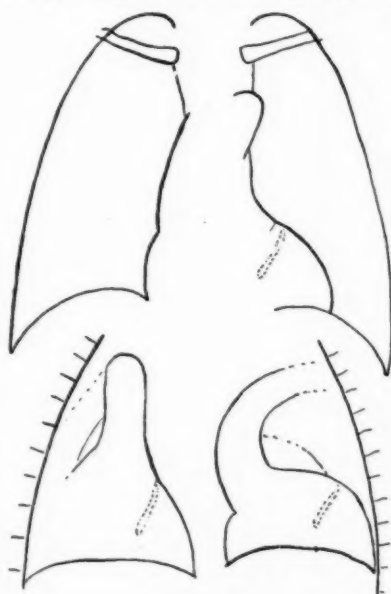
auch längs der Unterseite des Herzens an seiner Rückfläche hinauf; die Spitze ist vollständig frei. Auf den Lungen Zeichen eines alten tuberkulösen Processes, hauptsächlich in der rechten Spitze lokalisiert. Dasselbst fanden sich auch einige Cavernen. Lateral und unten in der rechten Pleura findet sich eine mächtige Verkalkung, und das Diaphragma zeigt auf dieser Seite eine geringere Beweglichkeit. (Tab. XIV, Fig. 1, 2.)

Es scheint mir ohne weiteres klar, dass in diesem Fall eine Pericarditis calculosa vorliegt. Die dichten pulsierenden Schatten, die bei verschiedenen Einstellungen an der Oberfläche des Herzens localisiert werden können, können unmöglich durch etwas anderes, als eine Verkalkung im Pericard bedingt sein. Auch die Verteilung des Kalkes ist die typische, mit den grössten Kalkplatten auf der Facies diaphragmatica des Herzens beim Übergange zur Facies sternocostalis. Von dieser gehen sowohl auf der Vorder- als auf der Hinterseite des Herzens Fortsätze aus, die zum grössten Teil dem Sulcus coronarius folgen. Die Spitze ist vollständig frei. Das ätiologische Moment ist in diesem Falle zweifellos Tuberkulose. Die Pat. hat eine alte Spitzenaffektion, offenbar tuberkulöser Natur, sowie eine Verkalkung einer Pleura, auch diese höchst wahrscheinlich tuberkulösen Ursprungs. Es findet sich kein Moment, das gegen die Annahme sprechen würde, dass die Pericardverkalkung sekundär in folge einer tuberkulösen Affektion des Pericards zu Stande gekommen sei.

Fall V. K. W. 77 Jahre, Mann. Med. Klinik II. Serafimer Lazarett 1921. Hat seit zwei Jahren an zunehmender Kraftlosigkeit, Druckgefühl über der Brust, schlechtem Appetit und zwischendurch Aufstossen gelitten, vereinzelt auch leichte Anschwellung an den Risten. *Bei der Aufnahme:* bleich, klagt über Schwindel und Müdigkeit. Das Herz nicht vergrössert, Töne dumpf, entfernt, Arrhythmie, weiches systolisches Blasegeräusch über dem ganzen Herzen, über der Aorta ein schwaches diastolisches. Blutdruck 135/97. Wassermanns Reaktion im Blute negativ. Im Epigastrium wurde in der Tiefe eine Resistenz palpiert und im Stuhl war Blut vorhanden. Bei zunehmender Entkräftung und Anämie sowie beständigen occulten Blutungen trat ca. einen Monat nach der Aufnahme der Tod ein.

Bei einer Röntgenuntersuchung d. 12. 5 wurde das Herz nicht vergrössert befunden, die linke Kammerkontur war aber etwas krummer als gewöhnlich, der Index (nach Bordet) war 2.5 cm. Die Pulsationen waren klein und unregelmässig, aber die einzelnen Herzkammern konnten mit gewöhnlicher Deutlichkeit unterschieden werden. Der Aortaschatten war etwas lang und dicht, der Durchmesser der Aorta ascendens 3 cm. Innerhalb des Herzschatens war ein kleinfingerlanger, dichter, pulsierender Schatten, links und nach hinten liegend und ungefähr der Grenze zwischen linkem Vorhof und Kammer entsprechend zu sehen. Er konnte nicht vom Herzen frei gebracht werden. Bei der Sektion einige Wochen später fand man einen Cancer ventriculi mit regionären Metastasen.

Das Herz war nicht vergrössert, aber die linke Kammer war etwas hypertrophisch. Am hinteren Teil des Annulus fibrosus bei der valvula bicuspidalis wurde eine kleinfingerlange feste Verkalkung gefunden. Diese Klappe ebenso wie die übrigen Mündungen und Klappen jedoch von normaler Weite mit weichen, geschmeidigen Klappen, abgesehen von einzelnen Kalkkörnern an den Basen derselben. In der Aorta einzelne atheromatöse Flecke. (Fig. 1, u. Tab. XIV, Fig. 4.)



Frontalbild.
lin. schräge Diam. re. schräge Diam.
Fig. 1. Fall V

In den beiden letzten Fällen waren die Verkalkungen viel besser zu sehen bei der Durchleuchtung als auf der Platte, und ich meine, dass für die Diagnose »Herzverkalkung« hat die Durchleuchtung grösseren Wert als die Aufnahme. Bei der Durchleuchtung können auch leicht durch Drehung des Patienten verdächtige Schatten lokalisiert werden. Es ist auch notwendig, besonderes Gewicht auf die untere Fläche des Herzens zu legen, wo offenbar die Prädilektionsstelle für die Pericardverkalkungen zu suchen ist. Diese Stelle des Herzens wird am besten im ersten und zweiten schrägen Durchmesser und mit von hinten und etwas von oben kom-

mender Strahlenrichtung untersucht. Es ist auch wichtig mit hinreichend harten Röhren zu untersuchen. Dies geht deutlich aus Fall III hervor, wo man mit einem weichen Rohr untersucht hat und wo die grosse Verkalkung sowohl bei der Durchleuchtung als auf der Platte übersehen wurde.

Wenn man innerhalb des Herzens an der Grenze zwischen Vorhof und Kammer Verkalkungen findet, muss man offenbar auch an Verkalkungen innerhalb des Annulus fibrosus denken. Verkalkungen innerhalb der Coronargefässe erreichen nämlich keine solche Mächtigkeit, dass sie mit unseren gegenwärtigen Hilfsmitteln in Frage kommen können. Die Verkalkung innerhalb des Annulus fibrosus hatte ein ganz anderes Aussehen als die Pericardverkalkungen. Diese kamen in grösseren oder kleineren Inseln oder Streifen vor, waren mehr oder weniger netzförmig angeordnet oder bildeten einen Ring oder eine

Schale um das Herz, oder es gingen von einer zentralen Partie Streifen und Striche aus. Die Verkalkung im Annulus dagegen war scharf abgesetzt. Wenn sie den ganzen Annulus umfasst, muss ersichtlich ein ringförmiger Schatten nachgewiesen werden können. Sie liegt natürlich auch nicht so an die Oberfläche des Herzens gebunden. Man muss sich jedoch gegenwärtig halten, dass es oft schwer ist so distinkt wie wünschenswert die hintere Herzfläche unterscheiden zu können.

Durch eine genaue Durchleuchtung muss demnach meines Erachtens die Diagnose Pericardverkalkung in ausgesprochenen Fällen leicht sein, und schon nach dem Aussehen der Verkalkung können auch gewisse Schlussfolgerungen in Bezug auf die Natur derselben gezogen werden.

Zusammenfassung

Verfasser macht darauf aufmerksam dass die Prädispositionsstelle für Pericardverkalkungen die untere Fläche des Herzens ist. Sie sind nach seiner Ansicht oft aufgeteilt, netzförmig oder bilden einen Ring um das Herz dicht unter dem Sulcus coronarius, oder bestehen aus von einem Zentrum ausgehenden Streifen. Eine Verkalkung innerhalb des Annulus fibrosus war scharf begrenzt und ohne Ausläufer. Für die Diagnose wird das grösste Gewicht auf Durchleuchtung mit hinreichend harten Röhren gelegt. Die Lage der Verkalkungen am Sulcus coronarius entlang bedingt die oft unbedeutenden Symptome von gestörter Zirkulation.

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Fig. 1. Fall IV. Frontalbild.



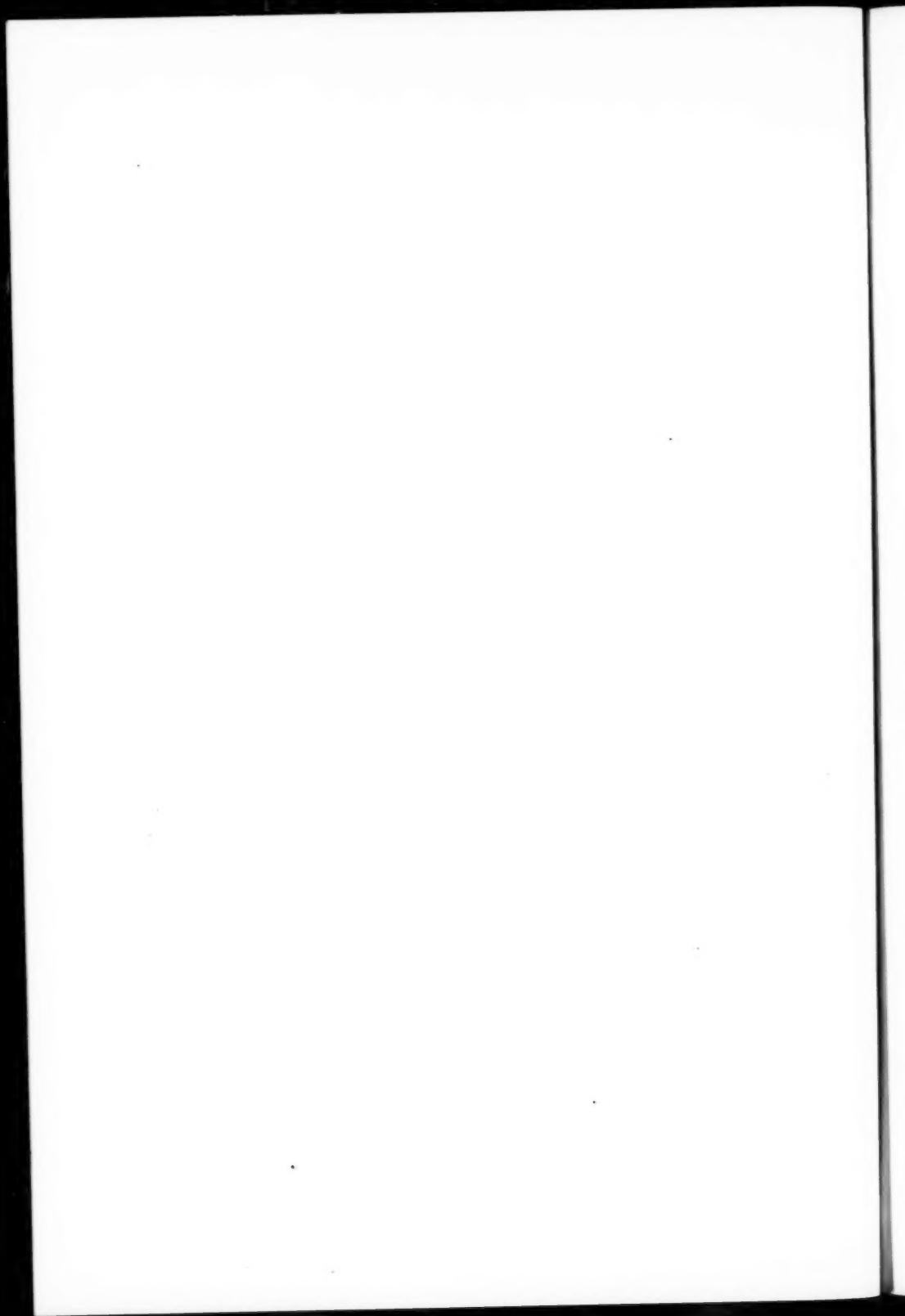
Fig. 2. Fall IV. Seitenbild.



Fig. 3. Fall III. Sectionspräparat.



Fig. 4. Fall V. Sectionspräparat.



A Hitherto Unknown Affection of the Patella in Children

by

Chr. M. F. Sinding-Larsen, M. D., Kristiania

(Tabulae XV and XVI)

In connection with a lecture by Dr. SVEN JOHANSSON on »An hitherto undescribed alteration in the apex of the patella», I made the following communication at the 3rd meeting of the Northern Orthopaedic Association in Helsingfors on July 6th of this year concerning 2 cases of *an hitherto unknown affection of the patella*. They turned out to be of the same nature as those treated in the lecture given by Dr. Johansson and very characteristic.

I had demonstrated roentgenograms of the one of my 2 cases (no. 2) and commented thereon as here at the meeting of the Kristiania Surgical Association on 20/12/20.

My cases are the following:

1) *Rigmor G.*, 10-year-old girl. Mother died of tuberculosis in 1917. The patient is the second of 2 children. Has had morbilli without sequelae. Had sciatica in Dec., 1918, recovered after keeping her bed for one month, and took dancing lessons. In April, 1919 she had pains in her *right knee*. I examined her on May 26th, 1919. *Condition on admission:* Looks healthy and bright, walks cautiously on her right leg which is rotated slightly outwards. Nothing abnormal in the columna, pelvis, hip or the sciatic nerve.

Considerable non-tender swelling below and on both sides of the right ligamentum patellae. No exudate in the joint; no capsular swelling; free motility. *Considerable tenderness on percussion of the whole of the anterior surface of the patella.* The quadriceps muscle on the right side somewhat slack. The left patella exhibiting nothing clinically abnormal; *roentgen rays* showed in the profile photos: the anterior outline of the *right patella* hazy, as if cortex were destroyed down to the apex; in the thickened soft parts in the front of the patella two or three narrow, oblong calcium salts- or bone shadows are seen (periosteal?) close in front of its anterior outline. At the back of the lig. patellae the soft tissue rhomboid is filled by diffuse shadows i. e. there is inflammation or oedema in the adipose tissue at the back of the lig. patellae (Fig. 1).

The outline of the *left patella* is distinct, with exception of the lower extremity, the outline of which is irregular (Fig. 2).

The anamnesis and the pronounced signs of inflammation of and below the right patella made me apprehend tbc. The patient was admitted to a clinic.

Pirquet was found +; there was general reaction on the use of *subcutaneous tuberculin* up to 0,01 gm., but no focal reaction over the patella. On 5/6/20 application of a plaster of Paris bandage with fenestra on the front of the knee and compression by means of cotton-wool through the fenestra.

On 16/7/20 she was quite free from spontaneous pains and not at all tender on percussion. No swelling. Removal of plaster of Paris. Motility almost normal. On 2/8/20 the *roentgen photos of the right knee* exhibit practically clean outlines of the patella; the apex, however, indented with double outlines; no bone- or calcium salts shadows in the soft parts in front of the patella. »The rhomboid» clearer (Fig. 3). On 4/1/21 her father informed me that she was quite well and could dance in the ballet and go ski-ing.

I was unable to get hold of her before travelling to Helsingfors, but on July 17th last she was examined once again: Both knees quite normal, the roentgen photos of the same likewise (Figs. 4 and 5). She is quite well and looks it.

2) *Karen F.* 11 years old. The second of 4 children. The father's lungs are said to have been suspected of tbc. She herself, as also her brothers and sisters, had been found by a specialist to be free from tbc. Has had morbilli and pertussis without sequelae. In the winter of 1919–20 she complained now and then that she could not run on account of pains »in her legs». Did not keep her bed, however, and got well after a time. In Oct., 1920, she felt pains again, this time »in both knees», especially on flexion. Otherwise healthy.

I saw her on Oct. 21st, 1920. She looked healthy and bright. There was free motility in both knees, no swelling. The quadriceps muscle rather slack.

The *right patella* was tender on percussion, the left patella exhibited nothing subj. or obj. abnormal. Roentgenograms showed slightly hazy outlines on the *right side* of the apex of the patella and just below the same, in the lig. patellae, an oblong curved calcium salts- or bone shadow. On tibia there was a suggestion of Schlatter's disease (Fig. 6). —

The outlines of the left patella were distinct but also here there was found below the apex a grain-sized calcium or bone shadow (Fig. 7). »The rhomboid» quite clear.

I presumed that there here existed a simple irritation (from over-exertion) at the point of attachment of the lig. patellae, on the *right side* both upwards (in the patella) and downwards (Schlatter's disease) on the *left side* only upwards (in the patella).

She was advised to keep quiet (neither to jump nor run violently) and quickly became free from pain.

On 6/30/21 she was controlled: No complaints, no tenderness over the patellae; normal knees. On July 1st, 1921 the *roentgen photos* of both knees were normal (Figs. 8 and 9).

In these 2 cases there exists in a 10 and 11-year-old girl respectively an *affection* of the patella, which is clinically one-sided, but which by the roentgen photos can be proved to exist distinctly although latently on the clinically healthy side. — In the first case there were more pronounced inflammatory symptoms than in the last one; but in both the affection would seem to have been absolutely benign, as under slight or no treatment it has disappeared in a very short time.



Fig. 1. Case I.
R. patella 26/5/1919.



Fig. 2. Case I.
L. patella 26/5/1919.



Fig. 3. Case I.
R. patella 2/8/1920.



Fig. 4. Case I.
R. patella 17/7/1921.



Fig. 5. Case I.
L. patella 17/7/1921.



Fig. 6. Case II.
R. Knee 20/10/1920.



Fig. 7. Case II.
L. Knee 20/10/1920.



Fig. 8. Case II.
R. Knee 1/7/1921.



Fig. 9. Case II.
L. Knee 1/7/1921.

The affection presumably arises on a greater exertion of the legs than they can stand; the point of insertion of certain tendons suffers more especially. It must be interpreted as the result of a »simple« traumatic periosteal or epiphyseal irritation, counterparts of which are not lacking. (Comp. Schlatter's disease or epiphysitis of the epicondyle of the humerus.) There can scarcely be any question of abnormal ossification; it would not assert its existence by inflammatory symptoms.

Apart from my demonstration which was not reported, this affection has not, as far as I know, been described previous to the occasion at the meeting in Helsingfors by DR. SVEN JOHANSSON and the PRESENT AUTHOR.

In the discussion which followed our lectures *Bülow-Hansen* said that in children, who complain of pain in their knees, he not infrequently finds marked tenderness on pressure beneath or at the back of the lower extremity of the patella. He has not taken roentgenograms of such; but it is not improbable that they have been of the same nature as the 2 cases here described.

Summary

The author gives the records and roentgenograms of 2 otherwise healthy girls, aged 10 and 11 years, who after overstraining themselves by dancing, jumping, etc. had complained of pain *in their knees*. When seen by the author the affection in both cases was *clinically unilateral*, located to one of the patellae, which was painful on percussion; only in one of the cases were the soft parts over and below the patella slightly inflamed (swollen).

Roentgen plates of the knees taken in profile, showed the anterior or lower outlines of the painful patellae hazy, with abnormal calcium salts — or bone shadows in the soft parts (periosteum?) along and below them, *the author thinks as a result of periostitis or epiphysitis through overstrain*. The tibia in one of the cases showed a mild form of Schlatter's disease.

The roentgenograms of the apparently healthy knee in both cases showed similar abnormalities of the patella in a lesser degree.

One case had a plaster of Paris bandage for 6 weeks, the other was simply ordered to keep quiet.

After about $\frac{1}{2}$ year the patellae of both cases were quite all right, and their roentgenograms normal.



Koehler's Disease, Especially with a View to the Pathogeny of the Same

by

H. Abrahamsen, M. D.

(Tabula XVII)

KOEHLER'S Disease is an affection of the os naviculare pedis; it appears in children of 5—6 years of age, frequently unilateral only, sometimes, however, bilateral. In most cases no preceding illness is found, more often there is a trauma in the anamnesis. The children complain of pains in the hollow of the sole, the gait is halting, there is soreness on pressure of the os naviculare, the muscles of the lower leg are somewhat atrophic, and frequently a lesser deformity of the foot is found, the arch of the sole being somewhat increased, and the foot turned in in a slight supination to ease the weight on the inner edge; flat foot is rarer. The symptoms can be fairly characteristic, but only a roentgen examination enables a correct diagnosis to be made; a diminished, condensed ossific centre is found in the os naviculare or the ossific centre is formed in islets, and the edges are slurred or frayed.

Since ALBAN KOEHLER at the German roentgen congress in 1908 published 3 cases of the disease in the os naviculare, which bears his name, about 50 cases, in all, of this disease have been reported. Even though all the diagnosed cases have not by far been published, and even though some few cases of MB. KOELERI are to be found under the diagnosis of flat foot, dolores pedis, or the like, the disease must, nevertheless, be considered rather rare. That the existence of the disease is known in the Scandinavian countries is due first and foremost to works by FORSELL, SCHÄFFER, KORITZINSKI, and MEULENGRACHT. The latter authors especially dwell at some length on the symptomatology, roentgenology, prognosis, and the therapeutics of the disease and also discuss the pathogeny very thoroughly.

The reason why I publish the following case of MB KOEHLERI is not so much to remind my readers of its appearance and the characteristic

roentgen finding but, above all, because I think that the case may contribute to the explanation of the pathogeny.

The history of the disease is as follows:

Knud E. O. 7 years old. Came to the hospital on April 15th, 1920. Without any preceding trauma he began four weeks ago to walk badly; his mother states that he becomes 'stiff' in the right ankle, and that he quickly tires. He has not complained of any pain. The boy looks in sound health and his gait is natural. The form and position of his right foot is natural; all movements in the joints of the foot are easy. Also the other joints are free. No paralysis nor paresis to be discovered. There is a shrinking of the calf of 2 cm. No soreness on pressure in the bones of the foot.

Roentgen examination: Nothing abnormal in the joint of the foot. The patellae are natural. The ossific centre of the os naviculare is on the right side only slightly indicated, while it is normal on the left side.

As it is supposed to be a question of *Koehler's disease* and as the ossific centre is so minimal, an attempt is made at treating it with thyroid. $\frac{1}{2}$ tablet of gland.-thyroid.-sicc. (15 cg.), is given twice daily. He is weighed at intervals of 8—14 days and when after 2 $\frac{1}{2}$ months' treatment he begins to lose in weight the tablets are abandoned. Roentgen shows the surprising fact that the ossific centre of the naviculare has grown considerably, it is about 7 mm. in length. It is highly irregular in form, and the case is now diagnosed by the roentgen physicians as typical of *Mb. Koehleri*.

Roentgen examination on August 27th: the ossific centre now 9 mm. long.

The anamnesis and the objective finding in this case of the disease give no hold for a diagnosis. Here is no soreness in the os naviculare, no change in the form of the foot, neither in the direction of an increased arching of the foot, nor of flat foot, in other words, no symptoms which might suggest *Koehler's disease*. Here is an atrophy and a disturbance in the gait which only appears on exertion. When I examined the boy it was therefore not clear to me that the affection had its seat in the os naviculare; the roentgen examination gave the surprising result that the *navicular ossific centre was almost missing*. It was at any rate so minimal that only a minor affected part was found, which must be explained as the first traces of an ossific formation. The picture so characteristic of *Mb. Koehleri* of the narrow, compressed, condensed, semilunar os naviculare was not found, nor the islet-like formation with frayed edges and uneven contours. On the other hand, a *defect* was found in this 7-year-old child — who ought normally to have had a well developed naviculare — which was of *quite another nature* than that mentioned by KOEHLER and later authors.

However, as it was considered a question of Koehler's disease or, if one may say so, the forerunner of this phase, and as the ossific formation was so minimal, the boy was for the following 2—3 months treated with gland. thyroid. sicc., which, to my knowledge, has not

been previously used in a case suffering from such an affection; it agreed well with him, and it appeared that rather a large ossific centre developed during this short period; it was irregular in shape and *characteristic of Koehler's disease*. (3)

What interest is now pathogenetically attached to this case? Here I must begin by quite briefly sketching the theories advanced in the literature. It having appeared after systematic examinations that diseases like syphilis, tuberculosis, ostitis fibrosa v. Recklinghausen, and the like, might be left out of consideration, the discussion has gradually been focussed on the three chief views 1) *trauma which causes a fracture of the sound bone*, 2) *fracture of a dystrophic bone* (pathologic fracture) and, finally, 3) *a belated formation or dystrophic process alone*.

The first view is adopted by most authors. SCHULTZE, STUMME, HÄNISCH, and others are of the opinion that the affection has arisen on a traumatic basis, rather as a *compression-fracture*. They think that the os naviculare is predisposed for this partly on account of the late formation, as the ossific centre does not appear until the child's 4th year, when that of all the other tarsus bones has already formed, and partly because in the position adopted on the top of the arch it is more exposed to traumatic influence. SCHULTZE has, further, by various traumas on corpses, tried to demonstrate experimentally the correctness of his views. The results are, however, far from convincing, as a strong blow and still stronger compression are necessary to bring out a picture that only »faintly» resembles *Koehler's disease*. When in consideration of the fact that the trauma in the histories of the disease is occasionally unable to be proved at all, and in others has been so slight that it can only be looked upon as a casual occurrence, without any real connection with the disease, it must be considered very doubtful as to whether SCHULTZE'S experiments can be accepted as proofs of the »pure» fracture.

It has evidently staggered other authors also, and they, therefore, have recourse to the theory of a combined causal agent, thinking that there is an innate or acquired dystrophy of the os naviculare, and the slight trauma, therefore, may easily cause the pathological feature.

PREISER considers *Koehler's disease* a typical traumatic disturbance of nutrition, he thinks that it is a question of primary rupture of the ligaments which are most important for the os naviculare and contain the larger vessels. PREISER here makes a comparison between the traumatic ostitis tending towards spontaneous fracture of the os naviculare carpi and KIENBOCK'S traumatic malaci of the os lunatum. The pathologically changed tissue reacts easily even on smaller traumas, and the pathological fracture arises. The comparison may lie near to hand, but it must be pointed out that the two affections in the carpus and

tarsus are almost always found in the anamnesis of fract. os. naviculare carpi (PREISER), whereas in *Koehler's disease* these are often missing.

Here in Denmark it is MEULENGRACHT (1915) more especially who has become the advocate of the pathologic fracture; and in France MOUCHET and ROEDERER (1920) have advanced the same views. As trauma cannot be proved in every case, MEULENGRACHT thinks that quite small, oft-repeated traumas or over-exertion may produce a compression of the os naviculare which is placed at an exposed point at the top of the arch of the foot. He draws a comparison with the metatarsal fracture found in soldiers, which can appear apparently spontaneously, and he writes, it lies close to hand to suppose, that the soft naviculare in young children may in a similar way yield to corresponding effects. M., however, thinks it in part wrong to maintain this explanation, as the possibility cannot be precluded that a defective formation or development plays an important part.

The third view, originally advanced by KOEHLER, is to the effect, that it is *only* a question of an *anomaly* in the *development*, a *dystrophic process*. KOEHLER lays stress on the facts that the affection is occasionally *bilateral* and that the *trauma* in several cases is missing or minimal, at any rate it is not a question of a fracture. FORSSELL adopts this view.

When we then look at the roentgen pictures of my patient, as reproduced above, I think that these are in favour of KOEHLER'S view of an anomaly of development. The first picture is taken at an earlier phase than any which has hitherto been published, as far as I am aware of; it does not yet show the character of *Koehler's disease*; *only during the three following months is the naviculare developed that is characteristic of this disease*. As there has been no trauma, it is thus difficult to imagine that a fracture can arise in the soft cartilaginous formation, and as the *first roentgen picture does not show the faintest resemblance at all to a fracture*, I am of the opinion that the case must be explained as a belated process of ossification. And, finally, one cannot divest one's mind of the idea that the thyreoid preparation has played a part in the ossific development. It is, at any rate, remarkable that so much osseous tissue has developed during such a short period. We must be allowed to explain the matter as if the medicament had given an impulse to the process of ossification and by that means quickened the latter process. It is otherwise difficult to understand the quickly advancing ossification. These are all circumstances which must support KOEHLER'S theory of an anomaly of development. Where the deeper cause of this anomaly is to be sought — well, that is still an open question which I shall not try to explain.

There is something to be said in favour of the view that the small

repeated traumas, especially in the form of a weight, may play a concurrent part and *compress the dystrophic bone*, but I consider this point of secondary importance. In opposition to MEULENGRACHT, MOUCHET and ROEDERER I think that the dystrophic process is the primary, and the compression, if any, the secondary phase.

I have to thank my chief, JÖRGEN JENSEN, M. D. for permission to publish the present case.

Summary

It concerns a 7-year-old boy who drags his right leg somewhat. On objective examination only an atrophy of the lower leg was found. *The roentgen picture* taken on april 22nd, 1920, shows that the os naviculare is missing; some minute spots mark the seat of its ossific centre. It may be imagined to be »the preliminary stage» of *Köhler's disease*. He was treated with thyreoidin for a couple of months, and the roentgen picture shows that the os naviculare has grown considerably and is 7 mm. in diameter. The contours are irregular and the picture is typical of *Köhler's disease*. One month later the diameter is 9 mm.

One cannot divest one's mind of the idea that the thyreoidin preparation has played a certain part in the development of the bone.

This case seems to speak in favour of KÖHLER's view, namely, that the disease is due to an anomaly in the development. The first picture is taken at an earlier stage than any other hitherto published picture — — as far as the author is aware of.

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Fig. 1. Right foot 22 Apr., 1920.



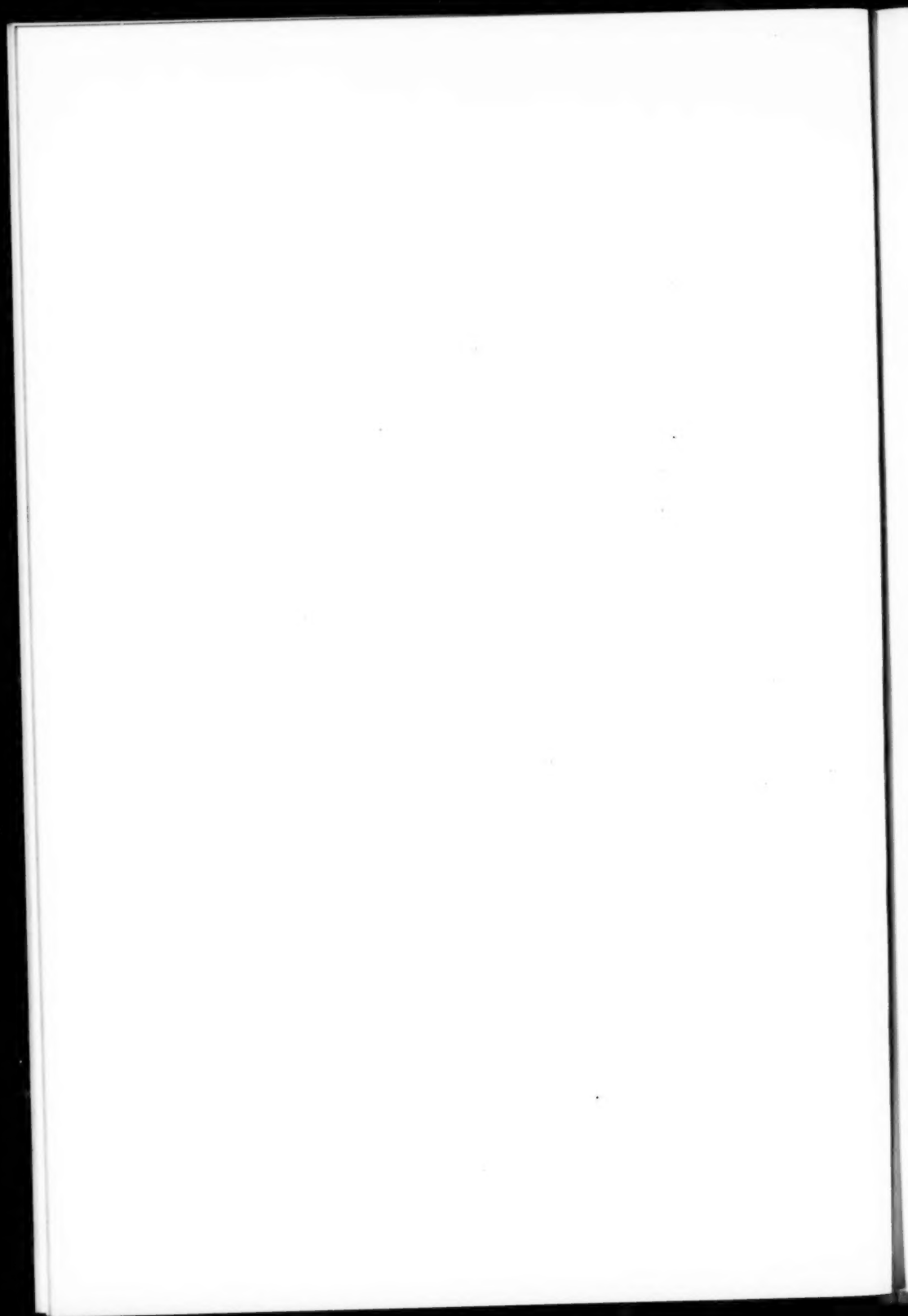
Fig. 2. Right foot 28 July, 1920.



Fig. 3. Right foot 27 Aug., 1920.



Fig. 4. Left foot 22 Apr., 1920.



The Roentgen Treatment of Morbus Basedowii

Introductory Address at the 2nd Congress of the Northern
Association for Medical Radiology in Copenhagen
Sept. 24th and 25th 1921

Joh. Fred. Fischer, M. D., Copenhagen

Nearly 20 years have elapsed since the American, WILLIAMS (in 1902), published the promising experiments which he had been the first to make in treating the Mb. Basedowii with Roentgen rays applied on the glandula thyreoidea. These experiments have since been carried on by an increasing number of physicians and gradually this method has become more and more general and is at the present moment supported by an extensive literature. The opposition which the Roentgen treatment has at times met with, has not been able to stop its progress, which especially of late years has become rapid, and the operative treatment of goitre must undoubtedly have felt the Roentgen treatment to be a very formidable rival.

In the year 1916, I communicated (*Ugeskrift for Læger*, N:o 41) the results of Roentgen treatment on 94 patients suffering from Mb. Basedowii, at the same time emphasizing the fact that considerable obscurity and uncertainty still prevailed in this branch of the Roentgen treatment, which, at that time, according to my opinion, was not used to the extent it certainly deserved. Part of the uncertainty has, it is true, been withdrawn since the appearance of the above-mentioned communication, but many questions still require to be examined and elucidated, particularly regarding the extent and duration of the results achieved, the indications of the treatment, and possibly arising complications, as well as the technique and the dosing to be considered most expedient.

Of the earlier literature I gave a detailed account in my above-mentioned communication.

Among the treatises of later date, I have — regarding Scandinavia — to mention several papers by NORDENTOFT (*Ugeskrift for Læger*, 1918,

No. 34 & 35, 1919, No. 29, and *Hospitalstidende*, 1916, No. 30); further a work by NORDENTOFT and BLUME, comprising 100 cases of Mb. Bas. treated with Roentgen rays (*Strahlentherapie XI*, 2).

From French and English sources the importance of the Roentgen treatment has been pointed out at an earlier date particularly by French authors, whereas it has been received with considerable reserve by the Germans, though the treatment has its advocates also among them. And one has the impression that this method is gaining ground in Germany. Thus, STEPP & WIRTH (*Th. d. G.* 1918) mention good results attained: out of 12 cases of Mb. Bas. 6 showed a distinct improvement, 3 a slighter improvement, whereas 3 proved uninfluenced by the treatment. Also LOREY reports a good result. (*Aerzt. Verein in Hamburg*, 20 Nov. 1917). WETTERER (*Handbuch d. Röntgen- und Radiumtherapi* 1920) also mentions the Roentgen treatment very favourably. He personally has but 14 cases at his disposal; but of these 8 felt quite well after the treatment, and the other 6 had improved considerably.

The 94 patients who, in 1916, formed the basis of my personal experiences regarding the influence of Roentgen treatment on Mb. Bas. all belonged to my private clinic, and thus my material had a somewhat partial character, which is not without significance, as I will show later on. Although I was attached to the two biggest municipal hospitals in Copenhagen, I had only in one single case had the opportunity of carrying out the Roentgen treatment of a goiter patient in the hospital, owing to the fact that, at this period, the head surgeons in question still preferred other methods of treatment. This has at present essentially changed, in so far as 165 patients with Mb. Basedowii have been treated in the hospital clinics (*Kommunehospitalet* and *Bispebjergs Hospital*) in recent years, 104 at the *Kommunehospitalet*, and 61 at the *Bispebjerg Hospital*.

During the same period I have privately treated 231 goiter patients, so that the total number under my treatment amounts to 396, and if to these are added the first 94, it makes a grand total of 490.

The decision, whether or not one really is confronted with a Mb. Basedowii sometimes affords considerable difficulty, and the number of patients here stated therefore requires some commentary.

Regarding the hospital patients, the diagnosis given at the hospital section has, of course, been acted upon, and, on the whole, it has been the severe cases that have been sent to be Roentgen-treated. As to the patients in my private clinic, all those have been weeded out, where the diagnosis was struma simplex, merely enlargement of the gland and no traceable disturbance of its function. Still, even among these patients there are several where the clinical picture has been of a nature to make it doubtful whether or not to include them. Not a

few can be described as »Basedowoid», or »formes frustes», patients with doubtful struma, but with distinct nervous symptoms and moderately increased activity of the heart.

The Roentgen treatment of these patients generally gives a very satisfactory result, and what seems to me to speak strongly for the fact that in these cases one has to deal with either disturbances of the gl. thyr. or the thymus, or both, is the duration of the improvement attained. I have for years followed these patients and have been able to ascertain the thorough change for the better in their state of health. And from their own people I have, over and over again, had confirmed the wonderful improvement of their mental as well as their physical condition. I have therefore considered that, in view of the here-mentioned change for the better being closely in accordance with that which may appear in undoubted Mb. Basedowii cases, I am entitled to bring them under the same group of diseases. Among the 231 patients in my private practice, these — with regard to the diagnosis — somewhat doubtful cases represent about one third; another third comprises patients undoubtedly suffering from Mb. Basedowii, though in a lesser degree; and the remaining third consists of the moderately severe and the severest cases.

It has not been in my power to draw a reliable line of division between a thyreogenic and a thymogenic form; it appears, on the whole, difficult to distinguish between the *vagical* and *sympathetic* goiter symptoms, and, after all, it is doubtful whether we ever see a case of purely the one or the other form. If a goiter, based solely on secretion anomalies in the thymus, exists, I should, from the experiences I have made, feel inclined to look for it chiefly in men; and in two such I have observed a form of disease closely approaching the complex of symptoms mentioned by EPPINGER and HESS.

How difficult the diagnosis of Mb. Basedowii may in reality prove, especially in its earliest phase, the following case seems to one to yield a good example.

Julius M., aged 35, was taken in at the Bispebjerg Hospital, department C (Head Physician: Dr. BING) in August, 1917 under the diagnosis diabetes mellitus. In his family there was found no disposition for diabetes. He had been a healthy child, but he was rejected at the military medical examination on account of varicose veins. During the last months before coming to the hospital, he had suffered a good deal from nervousness, owing, as he thinks, to overwork. In the course of a fortnight he lost 9 pounds in weight. His chief complaint was that of nervous restlessness, want of appetite and thirst. Once whilst he was at home, sugar had been found in his urine.

He was slender of frame, below middle height, with a pronounced neurasthenic tendency. Some tremor of tongue and hands. No exophthalmia, no struma. Pulse 84, regular. Slight extension of the 1st cardiac sound of the apex. The urine contained no sugar.

The opinion at the hospital section was that the case was one of *hyper-*

thyroidism and 8 days after his arrival he underwent cautious Roentgen treatment (3 H. under 3 mm. Al. filter in four fields). A fortnight after he had come to the hospital, unquestionable exophthalmia of the right eye was observed.

After a 3 weeks' stay in the hospital, he was discharged, according to his own wish, as he felt all right. At this period there was no increase of the cardiac activity, and no sugar showed in the urine.

Shortly after his return home, his state again grew worse, with a very rapid pulse (140—150). A month after the last treatment, he got a new irradiation as out-patient (5 H. 3 Mm. Al. filter in four fields). A few days after a pretty strong swelling of gl. thyroidea was noted, as also the above-mentioned exophthalmia of the right eye became more prominent, and a very considerable tremor set in. For several days sugar showed in the urine.

His state of health kept fairly unchanged during the following month. Pulse-frequency constantly about 150. He was very restless, tired and worried by tremor. Weight 116 pounds.

In the month of December, he again got Roentgen irradiation (10 H. 3 Mm. Al. filter in four fields) and again for some days sugar showed in the urine. Afterwards his state somewhat improved, but again grew worse during spring, after an attack of gastric and intestinal disease with fever which kept him in bed for some time.

In the course of the year 1918 he again got Roentgen irradiation, two exposures with 10 H. 3 Mm. Al. filter in four fields, and one with 15 H. 4 Mm. Aluminium filter in 3 fields. He grew gradually better, the pulse-frequency being towards the end of the year 90—100. The nervousness and tremor disappeared, the swelling of gl. thyroidea and the exophthalmia diminished.

In the course of the year 1919 he became still better. His weight increased to 140 pounds. He resumed his profession, felt quite well, and he can do his daily work without inconvenience.

The history of this case seems to me interesting, as the patient, when he came under observation in the hospital, did not show the symptoms characteristic of Mb. Basedowii but these developed gradually and in the end gave even a very characteristic picture of the disease. When, nevertheless, the diagnosis was given at so early a date, the reason was that the case was at once looked upon as *hyperthyroidism*, and not as a general nervousness owing to overwork. It seems to me not unlikely that, to begin with, we were confronted by an affection of a thymogenic nature, the complex of symptoms being quite in accordance with this. Later struma sets in, and the clinical picture gradually assumes the character generally met with, where we are not able to distinguish between the thymogenic and thyroogenic origin.

The case is, moreover, of interest, because it shows in a very fine manner the heating power of the Roentgen treatment. When the Roentgen rays, at the beginning, were applied with such great caution, the reason was that the patient's state was so unbalanced, and it was feared that a reaction might possibly set in after the treatment.

In how predominant a degree goiter is found in women, is shown

by the fact that among the 369 patients only 9 were men; of the 94 mentioned in 1916, merely 2 were men, the rest women.

The vast majority of patients have been between the ages of 30—45; the oldest patient was 63, the youngest 24 years. The duration of the disease has for the majority of the patients been $\frac{1}{2}$ to 5 years, only a very few have stated that they have had the disease for a greater number of years. On 8 patients strumectomy has at some earlier period been performed.

The patients may, as already mentioned, be divided into two chief groups: one larger one that have been treated as out-patients in my private clinic, and one smaller one, comprising those patients treated at the hospitals. This latter group is again divided into two parts, some of the hospital patients — 33 — having only been treated as out-patients without having been admitted to the hospital, whilst the remaining 132 have not been treated till after having been taken in at the hospital. These latter have always been kept in bed during the beginning of the treatment and among them we meet, as a matter of course, the severest cases.

When the result of the Roentgen treatment is to be estimated the two groups of patients, those belonging to the hospitals, and those proceeding from the private clinic, must be kept apart as they are in a very different social position, which is of no small importance.

As a rule, the vast majority of the Mb. Basedowii patients laid up at the hospitals belong to the class of people who earn their subsistence by physical labour, whereas this is rarely the case with those who go to the private clinic. That this circumstance essentially influences the final result that may be attained by Roentgen treatment, is evident, considering the fact that physical work or rather overwork, highly increases the risk of Mb. Basedowii.

Those patients, whom their doctor sends for private out-patient Roentgen treatment, have generally, at a very early stage of their illness, been enjoined to keep perfectly quiet and to avoid all bodily exertion. They have often been confined to bed, and they have, as a rule, without difficulty been able to follow the instructions given. And only when this sedative treatment has proved ineffectual, Roentgen treatment is resorted to. During the first period of this treatment, they are advised to obey doctor's orders without lying in bed, however, except for a couple of hours' rest every day, if their condition makes it necessary. Later on short walks are arranged, also partaking of the house-work or other work to which they are accustomed, yet with orders to cease the moment they feel tired or are in any other way inconvenienced by it. Gradually their range of activity is enlarged, and after 3—4 months, if the treatment is successful, they are able to do their daily work to the same extent as formerly.

The hospital patients who, as already mentioned, are chiefly recruited from the hardworking classes, are often mothers with several children, needlewomen, charwomen, factory girls, or women with similar occupations. As long as they are in the hospital, they get, in a large measure, the necessary rest, together with good and nourishing food. But as soon as they are discharged, they encounter the numerous claims of everyday life, and these hinder the convalescence from being carried out in the right way with gradual augmentation in their work and without mental and physical injury.

When in this way I draw so marked a line of demarcation between these two groups, it is owing to my experience that recurrences are much more frequent in the hospital group, in contradistinction to the private practice one, and nearly always the cause of the recurrence proves to be overwork, or domestic trouble. There is then a social momentum, which must be considered, when one has to make the prognosis of one's goiter patients, and this social momentum should not be undervalued. It has lately been pointed out by SOPHUS BANG at a Medical Congress in Aarhus (5th May, 1921). The recurrences will, as a rule, be overcome through a renewed Roentgen treatment and if possible a stay in the country, or by in other ways creating conditions likely to support the treatment.

Taken as a whole, the outcome of the Roentgen treatment is, as I have earlier found, that fully $\frac{1}{5}$ of the patients treated have attained a positive result. As for the last fifth part, where the treatment cannot be said to have been successful, it has, on the other hand, caused no change for the worse — one single case of death in connection with the treatment will be mentioned later on.

As a rule, one may say that the patients who suffer from but a slight struma, and whose nervous symptoms are not particularly marked, but where in the picture of the disease the tachycardia predominates, are those on whom the Roentgen treatment is most likely to fail.

By »positive» result of the treatment we here understand either the complete disappearance of all symptoms or a quite unmistakable improvement which stretches over a longer period.

A representation of the numerous medical histories is not possible, but the following brief details about 14 patients will be added, as the improvement that has set in is made manifest through photographs taken before and after the treatment. The number of patients photographed is but small, photographs having only occasionally been taken; and these schematic reports have the stamp of casuality, comprising promiscuously both slighter and severer cases. The photographs elucidate, better than many words, what has been attained through the treatment.

Case 1. Anna J. aged 46, married. Bispebjerg Hosp. Section. C. 21. VIII, 1917. Ill for 4 years. Treated in hosp. with medicine, 4 months in bed. Quick decline on returning home. Struma steadily increased in size. Strong periodical palpitations, difficulty in breathing, frequent vomiting. On the whole very exhausted. Strong exophthalmia. Diffuse soft swelling of gl. thyroidea. Systolic sounds, tremor man. Pulse 130. Weight 47 kgr. 21. VIII—31. VIII, 1917. 10 irradiations à 3 H. under 2 Mm. Al., during September and November. 8 irradiations. 3. XI. Less tired. 6. II, 1918. Struma diminished, tremor abating. P. 132. 14. II—15. II. 2 irradiations 10 H. 3 Mm. Al. 4. VI—8. VI. 4 irradiations. 23. X. Can look after her work at home. P. 120. 22. I, 1919. Is much better than before. P. 120. 10. III, 1920. Looks after her house, but gets tired quickly. P. 106. 23. II, 1921. Feels pretty well. P. 96. Weight 48 kgr.



Case 1. Jan., 1918.



Sept., 1920.

Case 2. Christine C., aged 49, widow. Bispebjerg Hosp. Section B. 3. I, 1918. Duration of illness $\frac{1}{2}$ year. Great restlessness and shiverings, profuse perspiration. Palpitation. Is very weak and tired. Loss of hair. Some exophthalmia. Pronounced shivering and tremor man. Swelling of gl. thyr., especially of the right lobe. P. 100. Weight 61 kgr. — 3. I—14. I, 1918. 1st series of irradiation. 23. I, 1919. Subjective change for the better. 28. I—30. I. 2 irradiations. 20. II. Swelling of gl. thyroidea diminished considerably. 13. III—15. III. 3 irradiations. 13. VI—18. VI. 3 irradiations. 25. XI—2. XII. 4 irradiations. 26. II, 1920. Feeling much better, does a little housework. P. 100. 28. VIII. Feeling well. No struma, no exophthalmia. P. 84. 20. X. Doing without difficulty her work as charwoman in an office. 23. VI, 1921. State of health continues good. Pulse 72. Weight 62 kgr.

Case 3. Anna G., aged 39, married to agent. Bispebjerg Hosp. Sect. C. 13. III, 1918. For a year nervousness, palpitation, restlessness, profuse per-



Case 2. Jan., 1918.



Aug., 1919.



Case 3. Febr., 1918.



March, 1919.

spiration. During the last month diarrhoea occasionally. Emaciation. Uniform swelling of gl. thyreoidea, each half the size of a hen's egg. Slight exophthalmia. Tremor man. & linguæ. P. 96. Weight 46.5 kgr. Sahli 108. Circumference of neck 30.5. 13. III—19 III. 1st series of *irradiation*. 3. IV. Felt better. P. 64. Weight 45.5 kgr. 12. IV—18. IV. 2nd series of *irradiation*. 15. V. Considerable improvement. 19. VI. Skin on neck pigmented. P. 62. Weight 51 klgr. 6. VIII. Appearance perfectly natural. No exophthalmia Weight 57 kgr. Struma disappeared 22. I, 1919. Feels well P. 80. Weight 57 kgr. 1921. Quite well.

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Case 4. March, 1918.



Case 4. May, 1919.

Case 4. A. D., aged 27, lieutenant in the Russian army. Kommune Hospitalet. Section III. 21. III, 1918. Taken prisoner $\frac{20}{8}$ 14. Spent 3 months in case-mate. III $2\frac{1}{2}$ years. Headache. Buzzing in the head. Fatigue. Difficulty in breathing, palpitation. Strong perspiration and diarrhoea. Considerable loss of weight. Gl. thyroidea much enlarged. Some exophthalmia. Tremor. Some dilatation of the heart. P. 140. Pronounced systolic sounds. Circumference of neck 42 ctm. Weight 67 kgr.

Apparently the *first irradiations* did not agree with him, as dyspnoea, palpitation and restlessness highly increased. It was found, though, that the chief cause of this was that he had too suddenly ceased taking bromine.

25—29. IV, 1918. 2nd series of *irradiation*, which he stood quite well. P. constantly very quick. 29. V—1. VI. 3rd series of *irradiation*. Discharged 13. VII. Feeling well. Exophthalmia less. P. 112—120. 30. IX—2. X. Again in the hospital for Roentgen treatment. Improving steadily, but suffers now and then from palpitation, and has still to take bromine. 1919. Three times admitted to the hospital, each time *treated with Roentgen rays*. In May, 1919 his state of health is as follows: Exophthalmia gone, as also the struma. He can without difficulty cycle and play tennis, and he walks upstairs without getting palpitation. The heart-sounds are normal and the action strong, regular and without systolic sounds. P. 74. According to later information, he has again taken part in the war in the south of Russia and has without fatigue sustained the exertions involved.



Case 5. June, 1918.



Dec., 1919.

Case 5. Margrethe K., aged 46, married to a bricklayer. Bispebjerg Hosp., Section C. 8. VI, 1918. Has for some years had struma. Has in the last year, and especially the last 3 months, been very nervous. Gets, with an interval of a few days, »fits of shivering all over the body», strong palpitation. Has difficulty in breathing. Emaciation.

Distinct, almost uniform enlargement of gl. thyreoidea of about the size of a hen's egg on each side. Tremor man. et linguae. Slight exophthalmia. P. 120. Weight 52.5 kgr.

8. VI—14. VI. 1st series of *irradiation*. 3. VII. Symptoms much abated. August & Sept. 2nd & 3rd series of *irradiation*. 24. IX. Has not for a long time felt so well. P. 114. Weight 59 klgr. Dec., 1918. Renewed *irradiation*. Has had the »Spanish influenza». 24. VII, 1919. Feels perfectly well, can without difficulty attend to her house-work. No exophthalmia. P. 108. Weight 57.5 kgr. 16. VI, 1920. Quite well. P. 108. Weight 64 kgr. May, 1921. Perfectly well. Weight 66 kgr.



Case 6. Oct., 1918.



Case 6. Sept., 1919.

Case 6. Henry C. aged 26, typographer. Bispebjerg Hospital, Section C. 10. X, 1918. The affection began $\frac{1}{2}$ year ago with very severe nervousness and difficulty in breathing. Has had to cease work. Considerable diffuse swelling of gl. thyreoides. Consistency soft. Moderately strong exophthalmia. Strong tremor manuum. Cardiac movements agitated. Cor. enlarged to the left. P. 120. Weight 55 kgr. Circumference of neck 39 ctm. 10. X—14. X, 1918. 1st series of irradiations.



Case 7. Nov., 1918.



Case 7. Sept., 1919.

6. XI. The skin on neck very red. Feels better. 4. XII.—9. XII. 2nd series of irradiation. 15. I, 1919. Feels well. P. 120. Weight 57 kgr. 24. I.—25. I. 2 irradiations, after which the skin on neck again red. 8. III.—14. III. 3 irradiations. 20. VIII. Has been at work two months. Feels subj. well. P. 108. Weight 58 kgr. 17. XII. Is now working 8 hours a day and feels his strength increasing constantly. P. 104. Weight 61 kgr. Circumference of neck 35.5 ctm. No exophthalmia. 1. IX. 1920. Attends to his work. Feels well. P. 100. Weight 65 kgr. marked telangiectasis on left side of neck.

Case 7. Johanne P., aged 20, unmarried, needle-woman. Bispebjerg Hosp. Sect. C. 2. IX, 1918. Noticed struma a year ago. Is nervous and restless. Very tired. Palpitation, perspiration, diarrhoea. Emaciated. Transverse, easily movable struma quite the size of a hen's egg. Tremor man. No exophthalmia. P. 132. Weight 37.5 kgr. Very much reduced in strength. 2. IX—30. IX. 4 *irradiations*. 23. X—26. X. 2nd series of *irradiations*. 27. XI. Feels much better. 3rd series of *irradiation*. 19. II, 1920. Feeling well. P. 100. Weight 56 kgr. 20. VIII. Feels tired, has worked hard. Illness at home. 29. XII—31. XII. 4th series of *irradiation*. 8. VI, 1921. Feels perfectly well. P. 72. Weight 55.5 kgr. On the neck telangiectasis.



Case 8. March, 1919.



April, 1920.

Case 8. Hans H., aged 34. Bricklayer. Bispebjerg Hospital Sect. C. 8. III, 1919. Discovered a fortnight ago a protuberance on fore part of neck, went to a doctor and was at once sent to the hospital for Mb. Bas. Complains of some palpitation, occasionally fatigue, is emaciated. Considerable diffuse enlargement of gl. thyroidea. Fairly marked exophthalmus. Indication of GRAEFE & MOEBIUS symptoms. P. about 80. Weight about 64 kgr.

8. III—15. III, 1919. 1st series of *irradiation*. 4 fields. 9. IV. Complains of tremor man. P. 120. Weight 68 kgr. 19. V. Feels better. P. 108. Weight 65 kgr. 3. IX. Feels well. Attends to his work. P. 88. Weight 70 kgr. 14. I, 1920. Feeling well. P. 78. Weight 76 kgr. 7. IV. Complete recovery. P. 72. Weight 80 kgr. 1921. Continues feeling perfectly well.

Case 9. 5. III, 1919. Martha C., aged 35, unmarried, needlewoman. Kommune Hosp. Sect. III. Operated 1914, Dep. V. Strumectomiae dext. Felt well for some time after the operation, though occasionally rather severe nervousness, on and off some palpitation. Was laid up in January in Dep. III for rheumatic fever and endocarditis, sent to undergo Roentgen treatment, because her goiter symptoms have returned: moderately marked exophthalmia, swelling of middle and left sidelobe.

Fairly pronounced tremor, slight perspiration, severe palpitation & headache. P. 136. Weight 50 kgr. 5. III—7. III, 1919. 1st *irradiation* series (3 irradiations). 29. III. Feels better, less headache. P. 136. Weight 54 kgr. 31. III—2. IV. 2nd series of *irradiation* (3 irradiations). 26. IV. Feeling anxious, but the subj. state on the whole better, does not feel tired. Weight 56 kgr. 26. V—30. V. 3rd series of *irradiation* (4 irradiations). 26. VI. Goes about her work, occasionally tired. 9. VIII. 4th series of *irradiation* (4 irradiations). 1. XI. P. 132 Is keeping well, attends to her work. No struma. No exophthalmia. 28. II, 1920. Feels well. P. 116. Weight 56.5 kgr. 21. VI. 1921. Has kept well till, 3 months ago, she again got rheumatic fever; but has quickly got over it. P. 116. Weight 53 kgr. No exophthalmia. No struma.



Case 9. March, 1919.



March, 1920.

*Case 10. Sophie M. aged 30, married to a painter. Bispebjerg Hosp. Sect. B. 23. IV, 1919. In course of the last year restlessness, anxiety, fatigue, palpitation, some perspiration, loss of weight. Moderately soft swelling of gl. thyroidea. Slight exophthalmia, some tremor man. P. 120. Weight 40 kgr. Circumference of neck 32 ctm. 23. IV—28. IV, 1919. 1st series of *irradiation*. 11. VII. Has been discharged since last treatment. Has felt well. Is again admitted for treatment. Looks rather nervous; perspiration, some exophthalmia, constant blinking, Menses not shown since March. P. 120. Weight 54 kgr. 11. VII—16. VII. 2nd *irradiation*. 27. VIII. Complaints of headache and fatigue. No appetite. P. 120. Weight 51 kgr. 4. XI—7. XI. 3rd series of *irradiation*. Some nausea after treatment. 14. I, 1920. Miscarriage in the latter part of Nov. Somewhat nervous and tired. 14. VII. In good health. Attends to her house. P. 120. Circumference of neck 30 ctm. No exophthalmia. 25. VIII. Feeling well. No struma. No exophthalmia. P. 108. Weight 54 kgr. May, 1921. In good health. P. about 100. Weight 54 kgr.*



Case 10. Apr., 1919.



Aug., 1920.

Case 11. 2. VII, 1919. *Martha G., aged 25.* Bispebjerg Hosp. Sect. C. The last 3—4 years nervous, restless, given to weeping. Palpitation and emaciation. Considerable fatigue.



Case 11. July, 1919.



July, 1920.

Diffuse swelling of gl. thyreoidea. Pretty marked exophthalmus, some tremor manuum. P. 120. Weight 48 kgr. Circumference of neck 33 ctm. 2. VII—8. VII, 1919. 1st series of irradiation. 4 fields. 4. VIII. Feels much better, not nervous. exophthalmia and struma unchanged. 13. VIII—14. VIII. Irradiated in two fields.

24. IX—29. IX. *Irradiation* in 3 fields. 26. XI. P. 84. Weight 54.5 kgr. 1. XII—5. XII. *Irradiation* in 3 fields. 18. II, 1920. Feels perfectly well. Has since the autumn had a situation as »lady-help», the work causing her no inconvenience. 3. VIII. Feeling well. Still some exophthalmia and some struma. P. normal. 8. VI, 1921. Feels well. P. normal. Weight 56.5 kgr. Slight exophthalmia and small soft struma.

Case 12. 30. VIII, 1919. *Alma C., aged 57, widow.* Bispebjerg Hosp., Sect. C. In good health till a year ago, when she got the »Spanish influenza», after which she could not regain her strength. Nervous, restless, palpitation, perspiration,



Case 12. Sept., 1919.



June, 1920.

fatigue and loss of hair. Strong trembling. Tremor man. Is emaciated, of sickly appearance. Moderate swelling of gl. thyroidea, essentially localized in the isthmus. Perceptible exophthalmia. P. 120, irregular. Weight 42 kgr. Circumference of neck 30 ctm. 30. VIII—3. IX, 1919. 1st series of *irradiation*. 30. IX. Tired, but quieter. During October and December 2 series of *irradiations*. 24. III, 1920. Still tired. Struma gone. P. 120. Circumference of neck 27 ctm. Weight 44.75 kgr. 30. VII. Feels well, good appetite. No exophthalmia. P. 108. Weight 49 kgr. 21. VI, 1921. Is feeling well. Attends to her work (rolling cigars). P. 116. Weight 55 kgr.

Case 13. *Hedvig A., aged 35, married to cycle-repairer.* Bispebjerg Hosp. Sect. C. 28. X, 1919. Has suffered for about 5 years from her present disease. Her condition has of late got worse. Is nervous, complains of palpitation, difficulty in breathing, feeling anxious, precordial pains. Loss of weight. Uniform swelling of side-lobes, as well as of isthmus. Some tremor, slight exophthalmia. P. 96. Weight

48.5
2nd
P. 14
well,
work.



Case 13. Oct., 1919.



Case. 13. Nov., 1920.

48.5 kgr. 28. X—30. X, 1919. 1st series of *irradiation*. 26. XI—28. XI. 2nd series of *irradiation*. 4. II, 1920. Less nervous, feels on the whole better. P. 142. Weight 52 kgr. 9. II—11. II. 3rd series of *irradiation*. 14. III. Is feeling well, but unable to work. 16. VII. Feels well. No exophthalmia, no struma. Stands work. 10. IX. P. normal. Weight 53 kgr. May, 1921. Complete recovery.

Case 14. Anna J., aged 18, unmarried. Private institute. 28/1 20. III for 1/2 year. Palpitation, restlessness, fatigue, languor, frame of mind variable, perspiration, and at times diarrhoea. Struma grown continually, has often a feeling of pressure. Eats disproportionately much. Moderately pronounced exophthalmia. Diffuse swelling of gl. thyroidea. P. 112. Weight 66.5 kgr. Some tremor man. 30. I

3. II, 1920. 1st series of irradiation. 16. II. Condition almost unchanged. Eats much less than heretofore. 12. III—16. III. 2nd series of irradiation. 7. IV. P. 84. Weight 70. Is feeling well. 14. VI—17. VI. 3rd series of irradiation. 23. VIII. Feels well. P. 72. Weight 71. Hardly any exophthalmia. Slight struma. 26. I, 1921. Feels well. P. 78. Weight 69 kgr. 14. V. Recovery.



Case 14. Jan., 1920.



June, 1921.

If we wish to make a comparison between the results of the operative treatment, and those attained by Roentgen irradiation, it would be unjust not to take into consideration that the Roentgen irradiation is tried on all patients without exception whereas in the operative treatment all patients not considered fit for an operation are beforehand rejected; and, when the result is summed up, we start from this reduced material and in such a manner the drawing of a comparison is made extremely difficult.

Already after the first series of irradiation, an evident change for the better in the patient's state of health will, as a rule, set in, the nervous symptoms vanish, the restlessness diminishes, and many of the former complaints cease. Concomitant with the subjective improvement, an objective change takes place in the patient's symptom-picture, particularly a quieter cardiac activity and an abatement of the tremor that may possibly be present.

A careful observance of the weight of the patients is highly desirable, for in the weight we possess a good means of judging their general state of health. In almost all the patients, provided the result of the treatment be positive, we shall find an increase in weight. This does not always set in during the first stage of the treatment, however, when even a slight loss of weight may be noted, but it will often occur a month or so after the beginning of the treatment. Occasionally the increase in weight may show very early; thus 9 have at present under treatment a patient who, during the 3 weeks between the 1st and 2nd series of irradiation, had gained 5 kgr. in weight. Even such a considerable increase in weight as 10–20 kgr., is by no means rare. The increase in weight is, as a rule, proportionate to the change for the better and one does not often find an increase in weight that is not accompanied by a corresponding change in the clinical picture.

Symptoms such as perspiration and diarrhoea will disappear comparatively soon, as also does the glycosuria which has been present in about 3 p. c. of the patients. In the first case, communicated in this paper, we find, strangely enough, glycosuria after each irradiation-series but afterwards it disappeared entirely.

Tachycardia, which has been a constant symptom, has in 25 p. c. of cases disappeared, in 50 p. c. abated considerably, but has remained nearly unchanged in the the remaining 25 p. c. of the patients, and here the pulse-frequency has been 100–120. In spite of the high pulse-frequency the patients have, as a rule, felt well. A certain lability of the pulse will often be present.

Exophthalmia is, as we know, the most obstinate symptom; this holds good, whether the treatment be operative or by Roentgen irradiation. In numerous cases, though, we see it disappear completely, particularly this may be expected where the symptom is of recent date, whereas an exophthalmia that has existed a longer time is not so easily influenced.

The struma has disappeared altogether or partly in $\frac{2}{3}$ of the patients; in the last third of the patients the swelling has remained apparently unchanged, though the improvement of their health has been considerable. The soft struma will preferably be influenced whilst the hard struma will first soften, and afterwards slowly disappear.

The duration of the disappearance of symptoms, or improvement is, with regard to the private patients, quite in accordance with what I have previously observed. On inquiry, many years after the treatment has come to an end, the patients state that they continue to feel perfectly well, and for many of these the period of observation has lasted for considerably more than 10 years. The relapses have been but few, but some of the patients have in the course of time disappeared, and

nothing has been heard of them. Occasionally some of these are traced, however; thus in 1916, on undertaking a general search, I succeeded in finding part of those who had not been heard of for a length of time, and it showed that their silence denoted that they felt quite well.

Regarding the hospital patients the result has not been equally good, relapses having been more frequent. The cause, as I have stated before, is to be found in the social conditions. Moreover, the time of observation for these patients has been rather short, hardly more than 4 years. The relapses are, as a rule, combatted by means of renewed irradiations, and many hard-working women have, with intervals of a half or a whole year, undergone renewed treatment, which has resulted in their having been able to attend to their work steadily. Now and then very strong exposures have been tried on them, but without greater result.

Goiter is caused by a poisoning of the organism through thyreotoxic substances secreted from diseased gl. thyreoideæ. Through operation the volume of the gland is lessened, and the quantity of poisonous matter carried to the body is diminished. The Roentgen irradiation calls forth a degenerative process in the gland tissue, from which a diminution of the gland may follow; but this is not necessary, though, for lessening the secretion, as it is quite conceivable that the function of the gland may be checked, or the compound of the secretion be altered as a result of the process of degeneration, without any simultaneous decrease of volume.

In *Ugeskrift for Læger*, 1920 N:r 17, Mrs MARIE KROGH has communicated some valuable experiments on the metabolism in goiter patients, also such as have been treated with Roentgen irradiation. The material is too small, though, to allow any conclusions regarding the influence of Roentgen rays on the standard metabolism, but a wider range of experiments is promised. The improvement in the state of nutrition and the subjective change for the better will, according to the experiments made up till now, only in very few cases be accompanied by a diminishing of the increased metabolism. It will be of importance clearly to conceive the metabolism in those patients, who have attained complete freedom from symptoms. Mrs KROGH is of opinion that an increased metabolism is an absolute condition, where a Mb. Basedowii is to be diagnosed.

If we now pass on to mention the complications which may set in through the Roentgen treatment of Mb. Basedowii, it will be natural first to examine whether the treatment can be said to entail any danger to the patient.

In my communication of 1916, I say that the risk attached to operative treatment makes it only right that scope should be given for other

and safe methods of treatment, and to these belongs the Roentgen treatment, which, carried out by a skilled hand, cannot be said to involve danger to the patient.

Shortly after this was written, there appeared in the Danish medical literature communications of 3 deaths of goiter patients after Roentgen treatment, namely 2 cases published by VERNING (*Hospitalstidende*, 1917, Nr 31) and one communicated by SECHER (*Ugeskrift for Læger*, 1918, Nr 41). These cases are rather isolated, in so far as in the home-literature only one single case can be paralleled with them, but in spite of this the question is, of course, of vital importance and requires examining.

Both VERNING and SECHER are of opinion that there is a prevailing probability for the deaths being directly connected with the Roentgen treatment. Nevertheless one may, as I have pointed out before (*Ugeskrift for Læger*, 1918, Nr 43), with a certain right maintain the opposite standpoint, that such a connection is here improbable, and I will state what, in my opinion, speaks in favour of this view.

All the three cases are of a very severe nature, and, as we know, it is by no means rare that in patients suffering from a severe Mb. Bas., a hyperthyreoidea, violent enough to cause death, may set in without a traceable cause.

I will here mention two cases, in this respect most instructive.

I. *Christian M.*, aged 35, sent from the Finsen Med. Light Institute, 27. IV, 1919. Kommunehospitalet, Sect. VI. Ill since 5 months. Restlessness, nervousness, sleeplessness. Loss of weight c. 15 kgr. Cardiac action vigorous. Brought to the Finsen clinic 13. IV. No exophthalmia. Swelling of gl. thyr. P. 120—130. Tp. normal. Diuresis natural.

21. IV, a Roentgen irradiation is given 5 H. on left side of neck under 5 Mm. Al. filter. 22. IV, slept badly. Cardiac action violent. Tremor. 24. IV, confused. 27. IV, confused, restless, sleepless. Is sent to K. H. Section VI.

Strong perspiration, strong tremor. Swelling of gl. thyr. No exophthalmia, Stellwag & Graefe. Restless and confused. Steth. cordis Ictus widely spread, and strong. Action regular, very quick. Systolic sounds all over precordia. P 136.

29. IV. State worse. P. 230. Respir. 64. Difficulty in swallowing. Death at noon, in spite of stimulants (digitalis, subcutaneous salt-water injections). P. M.: (Intoxicatio spont. Thyreoidism). Struma. Hyperplasia organ. lymph. Deg. parenchymatosa hepatis. Bronchit. pur.

II. *Johanne P.*, unmarried, aged 36. Kommune Hospitalet, Dep. VI. Admitted to Bispebjerg Hosp. 28. IV, 1919. Transferred to K. H.

Nervous for c. 10 years. Goiter 2—3 months. Struma. Exophthalmia. Perspiration, thirst, loss of weight, tremor. Has been treated merely with bromine and valeriana. 28. IV. Is restless, weeping, ill at ease. Tp. 37.9. P. 136. Strong Exophthalmia, Moebius, neither Graefe nor Stellwag. Tremor lingue et manuum. Gl. thyr. much swollen. Steth. cordis. Ictus spread a little beyond the mammary line. No systolic sounds.

Treated with morphia and bromine. Constantly restless, ill at ease, exhausted. Tp. rising. Fits of palpitation is getting very low. Death 30. IV.
P. M.: Mb. Basedowii. Struma. Thymus persist. Bronchit. pur.

These two cases are very much alike, and we may, if we like, add the first of them to the above mentioned 3 cases with total issue in consequence of Roentgen treatment, as the patient had a slight Roentgen irradiation 6 days before his death. The other patient, who also dies under an increasing hyperthyroidism, has, however, undergone no irradiation, and here the cause of the aggravated state that sets in is quite unknown; at all events the Roentgen rays cannot be made responsible.

It is, as I said before, by no means rare that a Mb. Basedowii ends in the above described manner, through a spontaneous hyperthyroidism setting in, and in this respect it is most significant that, at the same time and in the same department, we find two patients who both succumb to the disease in exactly the same manner.

The thought of a casual coincidence between the Roentgen irradiation and the outbreak of the hyperthyroidism cannot be dismissed, if only for the reason that the number of Roentgen-treated patients is so immense, and the deaths in connection with the treatment so few. Thus I have personally treated about 500 patients with Mb. Basedowii, and only observed one death that may be connected with the treatment. It must also be taken into consideration that all the cases where death has ensued have been patients with very severe forms of the disease and where consequently a fatal issue cannot be particularly surprising.

On the other hand, one cannot simply repudiate the possibility that the Roentgen irradiation, under certain circumstances, may have an unfavourable influence on a patient with Mb. Basedowii; for the Roentgen irradiation is a powerful remedy, at times even strongly influencing the patient's general condition and such a remedy is, of course, always under particular circumstances apt to have an unfavourable effect.

It is, of course, not without reason that, as far as I know, all authors, with the exception of a single one, advise great precaution when administering Roentgen irradiation to severely attacked patients. The unbalanced state, characteristic in just these patients, will always require great carefulness and attention, because every impulse, of whatever kind and however slight, may cause a much greater outcome than is expected. And here we enter on the question of dosage and the suitability of giving small or large doses.

Everybody, I believe, with the exception of NORDENTOFT, advises in severe cases small doses with suitable intervals, in order to see how the patient reacts against the irradiation. And it is hardly in the first place the fear of causing a hyperthyroidism through the intense irra-

diation that is here decisive, but more probably the dread of a Roentgen poisoning (Roentgen nausea) setting in. That such a poisoning, provided it be tolerably strong, may be dangerous to a very exhausted goiter patient is unquestionable, the more so, as the effect of the poisoning tells long before the eventual degenerative effect will develop. The Roentgen poisoning, about the causes of which we have but hypotheses to adhere to, shows very fitfully; in some patients it sets in with great violence, in others it does not appear at all, though just the same technique has been applied. NORDENTOFT himself writes that in easily influenced goitre patients one, now and then, notices a strong Roentgen poisoning setting in, with 2—3 days of vomiting, but the patients should not be exposed to such a shock, if it can be avoided.

If we go through the case-histories from VERNING and SECHER, we find nothing to justify the thought of a Roentgen poisoning likely to be conducive to the fatal issue of the disease, and I think it most probable, that here various circumstances coincide, and such a coincidence will now and then take place. The Roentgen treatment of Mb. Basedowii is in reality harmless, when given with the precaution which the state of the patient may require.

The question as to whether through Roentgen treatment of a goiter patient hyperthyroidism may be brought on, is, of course, of the greatest interest. NORDENTOFT, who has fought in favour of the large dose, »full dose«, as he calls it, says that if there is any danger at all, it must lie in the small doses, which may act as irritants. He mentions that, for instance, FORSELL (N. T. f. Terapi, Jan., 1914) states that small doses act irritatingly on gl. thyroidea and produce an increased cell-activity, whereas large doses have a degenerative effect. This, no doubt, is right, Forsell's observations do not aim directly at the gl. thyroidea, however, but are given in a general way; at all events we do not know any fixed irritative dose, for in numerous cases the affected gl. thyroidea has been irradiated with small doses, without any traceable increase of the cell-activity. That there exists an irritative dose for the carcinoma, seems on several occasions to have been proved, but, here too, we know but little of the size of this dose. SEITZ and WEINTZ fix it at 40—55 p. C. of the effective cancer-dose, which appears much too high. For if the irritative dose is really about half of the effective one, we would in numerous cases see a rapid development of the cancer, for in manifold cases this dose will surely have been applied, especially in recurrences of cancer mammæ, which has so often been insufficiently dosed. A rapid spreading of such a cancer mammæ is in reality extremely rare. If the dose necessary for the destruction of the tumor is not applied, this

will keep passive, or be somewhat checked in its development, if the dose has been tolerably strong.

The large dose (erythema dose) does not in itself carry any direct danger, but indirectly danger may arise through the large dose, if, in a very exhausted patient, it calls forth a Roentgen intoxication. Nordentoft, the only advocate of the large dose, seems himself to have felt misgivings about the large dose in all cases, for in his last paper (*Strahlentherapie* XI, 2) he writes that the two methods in so far are equal, as both lead to the goal; and he even does not deny the possibility of there being forms of Mb. Basedowii where the method with repeated small doses may eventually be preferable. But on this point we can only be taught by continued research and much greater experience.

The question of how far it is possible through Roentgen irradiation to cause an abatement of the function of gl. thyroidea, strong enough for a myxoedema to set in, is not yet clear, though several observations point in this direction. I have myself mentioned a woman, who, having first had Roentgen irradiations for tuberculous glands in the neck, and later on for a slight struma, got myxoedema, which soon disappeared, however, with the aid of thyreoidine. Meanwhile the communications regarding the hypofunction of gl. thyroidea accompanied by myxoedema, resulting from Roentgen irradiation, are too few to draw positive conclusions, the more so, as there are large numbers of Roentgen-treated cases, where no such a thing has taken place; and in none of my 500 patients, with the one exception mentioned above, have I observed anything of this kind.

The goiter patients' skin is very sensitive, very likely owing to the irritability of the vessel-system, wherefore we also in these patients, more often than in others, see a passing erythema arise shortly after the irradiation. Whilst this phenomenon quickly disappears and in so far is without significance, an ordinary reaction erythema may also easily set in even with moderate irradiation, where, under ordinary circumstances, one would not expect it. This urges to precaution, especially in recurring cases, where there is a question of a longer period of treatment. Lasting changes in the skin of such patients may easily arise, and often they take one by surprise, no erythema having beforehand been traceable. In about 3 p. c. of the here mentioned patients the Roentgen treatment has been accompanied by more or less pronounced telangiectasis on the skin.

In 2 patients a strong and protracted hoarseness has come after the irradiation, and with the aid of laryngoscopy it has been seen that the vocal cords were slightly red and swollen, but these symptoms have again disappeared without special treatment, though in one of the patients

only after the course of several months. In some cases a passing swelling of the lymphatic glands has been observed, and in a few cases dryness of the mouth, owing to diminished salivary secretion; these accompanying symptoms have set in where the field of irradiation has been the largest and have been located far back on the side of the neck.

The unfavourable result of the Roentgen treatment, formerly emphasized by VON EISELSBERG, viz., that fibrous tissue adhesions round gl. thyreoidea were apt to make a later operation more difficult, has not only remained unconfirmed, but has been refuted from many quarters. Adhesions between the capsule and its surroundings will often be observed, and numerous communications tend to prove that these adhesions are not more frequent in Roentgen-treated cases than in such where an irradiation has not taken place.

MANNABERG'S observation (*Wiener Klinik* 1913, No. 18) that through irradiation of the ovaries on goiter patients approximately the same result may be reached as by irradiation of gl. thyreoidea, has not been confirmed. STEIGER, it is true, states (*Strahlentherapie VIII*) that of 3 cases of myoma complicated with Mb. Basedowii, he has in two of the patients noticed a favourable influence on this latter disease through the setting in of amenorrhoea; but, on the other hand, VON GRAFF (*Wiener klin. Woche* 1914, 5) communicates, that he has seen a Mb. Basedowii develop in connection with an amenorrhoea, so that this point must be said to be rather obscure. I personally have had a single case of myoma, complicated with struma, but I did not notice that it was influenced by the oncoming amenorrhoea. That there is a certain connection between the functions of the ovaries and the irradiation of gl. thyreoidea, seems evident from the fact that not a few of the female patients, who have otherwise had quite regular menstruations, state that during the treatment meno-pauses have set in, lasting for a couple of months.

Some patients, about 30, have become pregnant in the course of the treatment, or at all events during the time of observation. Those concerned have suffered from a natural fear as to how events would turn out, but in no case it has been proved that pregnancy or child-birth had aggravated their condition.

Regarding the technique of the irradiation, it has somewhat varied according to the degree of development of the disease. To very severely attacked patients 3 H. have been applied (5 Holz knecht units are counted equal to one Sabouraud-Moiré unit) through 3 Mm. Al. filters with an interval of a couple of days. All in all, 4 fields of skin have been irradiated, viz., the two side-fields of the throat and the middle-field,

care having been taken to avoid crossing of the rays, and, finally, one field comprising the upper part of sternum.

If the patient has shown the slightest cause for alarm, the pause between the irradiations has been prolonged; but if they have borne the treatment well, they have after the lapse of a month received a more intense irradiation, namely 8—10 H. under the same filter in the above mentioned four fields.

The less severely attacked patients have from the beginning got a larger dose, and the out patients have as a rule got 8—10 H. through an aluminium filter 3—4 Mm. thick, one of the four fields having been irradiated every day. About a month later the same dose has been given, after which there has been a pause of 2—3 months; finally, 10—12 H. through 4—5 Al. in 3 fields, and with this the treatment has in most cases come to an end. If later on a relapse has set in, the latter dose has been repeated with an interval of several months.

At an earlier period somewhat larger doses have been given, but, on account of the skin, they have been decreased and the focal distance augmented. Taken as a whole, the doses here mentioned are not small, but larger than those mentioned by most authors. Thus HOLZKNECHT gives, according to WETTERER, 10 H. through $\frac{1}{2}$ Mm. zinc in one field, and then pauses a fortnight, after which a new field is irradiated in the same way. And LENK (*Röntgentherapeutisches Hilfsbuch, Berlin, 1921*) gives two irradiations of each 6 H., 3 Mm. Al., with an interval of 8 days, and repeats this 2—6 times. FORSELL's doses, too, are somewhat smaller. After a test-dose 3 H. (3 Mm. Al.) on the side-fields of the neck, he gives 10 H. on the same fields spread over 4 days, and 10 H. on Manubrium sterni, and this dose is further given twice with an interval of 4—6 weeks.

As to the indications one would like to give regarding the Roentgen treatment of Mb. Basedowii, the question must first of all depend on the position assigned to it, as compared to the surgical treatment. If we think, as some do, that the two methods of treatment are equally valuable, or, as does LEDOUX-LEBARD, that the Roentgen treatment is superior to the surgical one, the consequence will be that we shall not hesitate in applying this treatment to all cases. In accordance with this we also see that, for instance, LENK (*Röntgentherapeutisches Hilfsbuch, Wien 1921*), does not give any contra-indications, but declares the Roentgen treatment superior to every other treatment and insists upon its being unconditionally tried before one proceeds to an operation.

FORSELL (*Lærebog i intern Medicin, 1921*) is considerably more reserved, saying that our range of experience is still too limited, and, above all, the time of observation too short for a comparison with other

methods, or for the stating of a safe indication for the Roentgen treatment of Mb. Basedowii. Further, he says that, considering the risk which is still undoubtedly incident to the operative treatment of Mb. Basedowii, we may even now be entitled to try Roentgen treatment, together with the internal treatment, before an operation is decided upon, provided a postponement of some months cannot be supposed to involve danger to the patient. On relapses after an operation, as well as in inoperable cases, a trial with Roentgen rays will certainly be justified.

If one takes into account the experiences that are to be reaped from the material in hand, the indications regarding the Roentgen treatment are as follows:

The lighter, rudimentary, cases of Mb. Basedowii, where the usual medical treatment has proved resultless, ought decidedly to undergo Roentgen treatment. The result will, in the greater number of cases, prove a complete and lasting recovery.

In moderately severe cases the Roentgen treatment will likewise be indicated, because it must be considered safe if carried out with the necessary precaution, and because, as a rule, the result of the treatment will prove satisfactory. Should the radiotherapeutics not lead to a favourable result, operation must be resorted to; the postponement need give rise to no anxiety, the less so, as there is not the slightest proof, nor even probability of the Roentgen treatment having made the operative incision more difficult. If we meet one of those cases where the irradiation proves of no use, the time of observation should not be stretched beyond 3—4 months, there being but a slight probability of an improvement setting in later, if it has not appeared in the course of this time.

In severe chronic cases, which nevertheless show some oscillation of the condition, the Roentgen treatment should be tried, particularly if the operation, on account of the patients state of health, has to be put off. Through this treatment we may possibly render an operation superfluous, possibly improving the conditions for an operation. The stagnant chronic form of Mb. Basedowii, where there is imminent danger of a rapid degeneration of the myocardium, must be operated, if this is possible, if not, Roentgen treatment must be tried.

All inoperable cases and all relapses after operation should be Roentgen-treated.

The more recent a Mb. Basedowii is, the greater is the chance of the Roentgen treatment resulting in a complete recovery, so that all symptoms disappear. If the medical treatment does not help in the course of a reasonable time, more effective treatment should be tried, and the choice must now be made between operative incision and

Roentgen treatment. The former implies no inconsiderable risk, the latter must be said to be without danger; and thus we must feel justified in choosing the latter, if we do not see a danger in putting off the operation, this however, I am sure, will rarely be the case.

Summary

Among 490 patients treated for goiter there were 11 men, the remainder women. The material at hand is divided into 2 parts, viz: those treated at hospitals, and private out-patients, the majority of the former belong to the working-classes, and the latter for the most part to the well-to-do classes.

The prognosis varies within these two classes; it is most favourable for the well-to-do, because the working class patients are not, as a rule, able to take the care so necessary in this disease. In $\frac{4}{5}$ of the cases a positive result is attained, complete or partial cessation of symptoms. Recurrences occur principally among the poorer patients; on the whole, the duration of the results attained is satisfactory. Nervousness decreased rapidly, increase in weight is usual, in several cases the increase has been about 20 kilo. Perspiration and diarrhoea disappeared, likewise glycosuria which has been observed in 3 % of patients. In 25 % the pulse has become normal and in 50 % it has decreased considerably in frequency. Exophthalmia in several cases has disappeared, if it has not been of long duration.

Serious complications are precluded if the administration of Roentgen rays is carried out with care, so that in the case of severely attacked patients one should not run the risk of Roentgen intoxication.

The usual dose has been 10 H. with 3 Al. filters on 4 fields, the one on thymus; but a smaller dose to begin with if the patient has been seriously attacked.

One should not be too exacting with regard to the indications for Roentgen treatment. Only in cases where a postponement of an operation is likely to cause danger should this treatment not be indicated.



Radium Treatment of Changes in the Thyreoid Gland

Introductory Address at the 2nd Congress of the Northern Association for Medical Radiology in Copenhagen 1921

by

S. A. Heyerdahl, M. D.

During my practice little opportunity has hitherto been given me to try to apply radium on the thyreoid gland when subject to changes. One of the chief reasons why this has not been done is because preference has been given to the roentgen rays, and this is again chiefly due to the fact that the roentgen apparatuses have been established almost all over the country.

While the radium, therapeutically applied, is concentrated in our country, so to say, in some very few institutes and infirmaries, the roentgen apparatuses, on the other hand, are installed in almost every infirmary in the country and also in numerous special institutes.

Thus the roentgen rays have got a good lead and the favorable results that these rays can show in the case of the toxic goiter is the reason why the radiologists as a rule get patients suffering from this illness expressly for treatment with the roentgen rays and not with the radium ones.

Altogether, radium is less known in our country as a remedy against struma and toxic goiter.

When I, in spite of comparatively little experience as to the effects of radium by changes of the thyreoid gland, have undertaken to read an introductory paper on this subject at the congress, then it is due to the fact that »radium», according to my opinion, also ought to have a »place in the sun» next to his brother »roentgen» that lately seems earnestly to mean to knock him out from most of the domains of the therapeutic rays.

In the year 1905 ABBÉ of New York treated a case of goiter by burying a radium tube in the gland and reported a remarkable success.

Later on other workers, among them WICKHAM, DEGRAIS, DOMINICI, BARCAT, AIKIN, CLAQUETT, have used radium by external application and reported gratifying results.

It is specially American physicians (and radiologists) who have launched radium as a treatment for goiter preferable not only to surgery but also to x-rays.

One of the most experienced physicans in this domain, Dr. AIKINS (Toronto, Canada)¹, has treated about 100 cases of this disease in the last twelve years.

In acute cases he has found that treatment by radiation must be supplemented by (a) rest in bed, (b) dietetic treatment, and (c) treatment by drugs. The combined treatment is always more efficacious than either alone.

In applying radium over the thyreoid gland the radium is so screened as to prevent the action of the short but powerful Beta rays and to obtain the benefit of the more penetrating gamma rays.

Dr AIKINS prefers the flat applications (he uses most frequently 4 cm. x 4 cm. containing 10 mg. radium element). The plaques are screened with two thin aluminium screens or one fairly thick brass one (about 0.8 mm.), with a layer of felt.

As a rule he makes applications of three hours duration, giving a first treatment of from 150 to 360 mg. hrs. He finds it preferable to give smaller doses rather frequently than concentrated heavy dosage. The first treatment is usually completed in three days and then he leaves an interval of about 6 weeks between applications.

If the case is very advanced, the patient is treated in a hospital; less severe cases are treated in the Roentgen Institute for shorter periods.

As compared with x-rays in the treatment of toxic goiter radium has the following advantages: (a) absolutely constant emission of rays, and therefore exact dosage possible; (b) far greater penetration of its rays, so that the deeper parts of the gland are reached; (c) no noisy exciting apparatus, so that the treatment can be applied at the bedside without in any way disturbing the patient.

Dr. A. N. CLAQUETT (Chicago) also prefers radium in the treatment of goiter. He has treated 47 cases of exophthalmic goiter with radium; the first case being treated in September 1917. Of these cases six had already been operated on with recurrence of symptoms as bad or worse than before. Seventeen cases were declined as operable risks by some of the best surgeons.

Two cases with very bad broken compensation of the heart have died since treatment from acute dilatation, one three months after treatment, the other five and a half months after.

¹ Radium in toxic goiter (the Americ. J. of R. August 1920).

There have been good results in all the other cases and surgery has not been necessary after the radium treatment in a single one of the forty-seven cases.

Conclusions: Dr. CLAQUET believes radium should be given a trial in exophthalmic goiter.

FIRST: There is no mortality, no scar, or pain, no long hospitalization. Three or four days suffice for the treatment.

SECOND: Its advantage over the x-rays are no discoloration of the neck — less time consumed in the treatment — simpler to apply.

THIRD: The thymus gland can be treated.

FOURTH: While surgery in removing proliferating cells leaves others behind and by ligating still leaves some of the blood supply more or less undisturbed, the selective action of the radium rays to a much greater degree destroys the harmful cells and also causes a much more symmetrical diminution of the blood supply.

FIFTH: It can be used in cases where surgery fears to venture or has failed.

SIXTH: Surgery has not been necessary after the radium treatment in one of the forty-seven cases.

In the Radium Institute of the Rikshospital 16 cases of goiter, whereof 8 of pronounced toxic goiter and 8 of plain goiter without toxic symptoms or with milder nervous symptoms have been treated with radium since 1913.

Added to this 8 cases of inoperable struma malignum, most of them of cancerous matter, have been treated with radium it being not quite out of the question that they could obtain temporary relief from their sufferings. 5 of these patients have been temporarily improved:

The 8 cases of plain goiter have been partly serious cases which have been subject to ray treatment, the goiter being either considered as inoperable or because it was thought connected with too great a risk to resort to operation or because the patient objected to operation.

In all 8 cases the goiter has diminished through the radium treatment. In 2 cases almost complete cure was achieved; in 6 cases a change for the better.

With the patients that suffered from nervous symptoms, these disappeared during the treatment.

A few patients with big goiters and pronounced dyspnoea were quite relieved of this and the goiter was considerably reduced. An inconvenience by the radium treatment of plain goiter is the comparatively long time it takes before a notable improvement can be recorded and that in but few cases will the goiter disappear altogether.

Another inconvenience which we also in some cases have experienced

at the radium institute is the appearance of telangiectasis and atrophy of the skin, and especially in those cases where the radium treatment has been protracted and where during the whole time lead-filters of 1 mm. and 20 hours irradiation have been applied.

As the skin of the throat is very sensitive to the radium irradiation, comparatively thick lead-filters must be applied, and the thickness of the filters will have to be increased gradually.

In cases of plain goiter I do not believe the radium treatment will attain any general application, at any rate not by external irradiation.

For treatment by radium (eventually roentgen rays) those cases will be appropriate where, for some reason or other, operation cannot be undertaken or where operation is combined with great risk.

Most of the cases at the institute which were treated by radium irradiation were just such ones where operation for said reasons could not be undertaken.

As a rule 8 to 16 ctgrs. of radium¹ in tubes with 1 $\frac{1}{2}$ to 3 mm. lead-filters distributed over the goiter have been used. Time of treatment — 20 hours. The sittings have been repeated every six weeks or every month; up to ten sittings in all. The thickness of the lead-filters has been increased little by little up to a maximum of 3 mm. of lead.

Of toxic goiter 8 cases have been treated with radium; whereof 1 case almost cured, 5 improved and 2 not cured. These patients have been under observation from 2 to 5 years. The treatment has continued for a period of from 3 months to 1 year.

The radium treatment had an absolutely favourable influence on the general state of health and on the nervous symptoms. The sleep and appetite improved, the weight increased and the state of mind became more composed. The pulse calmed and the size of the goiter diminished. Least influence had the radium treatment on the exophthalmia.

On a woman 30 years old (who got 2 sittings) with strongly developed exophthalmia and Moebius +, but without apparent enlargement of the thyroid gland the radium treatment had no curative effect. The patient disappeared after the treatment in 2 sittings and she has not been heard of since.

Another patient, a man 47 years old, was operated upon 5 months after the beginning of the radium cure. While treated by radium his state of health improved.

In the 6 cases of toxic goiter with good results, the exophthalmia appeared in 4, the goiter in 6, the tremor in 3, quick pulse in 5, symptoms of heart disease in 5 of them. — Nervous symptoms in all 6 cases. Pronounced emaciation in 4 cases.

¹ Always radium bromide.

Struma (8 cases)

whereof 2 cured and 6 improved

Cases cured

Case I: T. M. widow, 45 years old. For a period of 8 years she has noticed that her throat was inflated and that her voice had changed somewhat; she has never been hoarse for any length of time. Has suffered from palpitation of the heart and a labile state of mind. Admitted to the radium institute on the $12/11-14$.

St. pr. No exophthalmia, no tremor. Pulse 72, regular. Complains of pressure on the ears and of heart palpitation.

On the throat between the manubrium sterni and the larynx a diffuse swelling is observed that spreads itself somewhat out to the sides. Tumour is soft and does not infiltrate the skin, is displaceable against it and not sore. Circumference of the throat 35 cm. No palpable glands. Treated with radium from the $12/11-14$ to the $31/5-16$ in 8 sittings at intervals of from 2 to 4 months; tube-preparation, 6 to 10 cgrs, 2 mm. lead-filter, for twenty hours.

$15/4-15$. Tumour on the throat considerably reduced; the circumference of the throat 32 cm.; now no heart palpitation and no pressure on the ears.

$13/12-15$. The thyroid tumour now all but disappeared; circumference of throat 32 cm. Feeling well. $14/2-16$. Free from symptoms. $11/9-16$. Free from symptoms. $16/1-18$. Cured.

Case II: A. N. Workman's wife, 56 years old. 18 years back she commenced to feel troubled when swallowing and noticed that the throat swelled round about the larynx. She improved after internal treatment.

At the end of February this year the tumour on the throat began to grow again; lately she has become a little short-breathed when she walks a little quickly. She has suffered from perspiration, heart palpitations and thrills of agony.

She was admitted to the radium institute for struma on the $1/7-16$.

St. pr. The patient looks well, complains of heart palpitations. Pulse 80, regular. Respiration 24, hardly audible. Clean heart sounds. On the neck in the regio thyroidea gland a diffuse tumour-like swelling was observed. The circumference of the throat is 40 cm. The tumour is of a soft elastic consistence. The skin covering the tumour is easily displaceable. Tumour moves with the swallowing. No tremor, no exophthalmia. Her hands are clammy and perspiring.

Radium treatment from the $1/7-16$ to the $10/2-18$ in 10 sittings, 8 to 12 cgrs. (tube-preparation). 2 to 3 mm. lead-filter, covering throat tumour for twenty hours.

$10/10-16$. Pulse 88. Throat tumour smaller. Complains less of heart palpitation than before. General health good.

$19/3-17$. Pulse 84. Throat tumour lessens steadily. Circumference of throat 39 cm. Is feeling well; seldom heart palpitations.

$9/2-18$. Pulse 72, regular. Throat tumour now just but visible. Throat circumference 37 cm. Is feeling well. No heart palpitation. Discharged as cured.

Cases improved

Of the improved cases there was a patient with an extraordinary large-sized struma, which was not fitted for operation; the patient was admitted to the radium institute from the surgical section A.

Case 1: B. B. A girl 16 years old. Three years ago she noticed a tumour which spread over the front and sides of the throat; It has grown gradually and slowly till this summer and from that time faster. From time to time a little hoarse with coughing-spells.

Since autumn she has had dyspnoea and now and then heart palpitations. Has not suffered from incommmodation in swallowing and has no pains. Admitted to the radium institute on the $26/12-12$.

St. pr. The voice somewhat hoarse. Pulse 88. Respiration a little strained—16. A large tumour, symmetrically situated, of horseshoe form is perceived, which covers the front and sides of the throat stretching downwards from manubrium sterni and clavícula and upwards to mandibulum; behind it reaches from 3 to 4 cm. before the foremost ridge of the m. trapezius. In front the tumour measures 13 cm. from below and upwards. The circumference of the throat is 46 cm. at the, broadest part. The whole tumour moves when swallowing. The consistence of the tumour is firm, strained and the surface somewhat uneven. A movable gland big as an almond is felt a little in front of the right jaw angle. No exophthalmia, no tremor.

Radium treatment from the $27/12-12$ to the $30/1-14$ in 10 sittings; chiefly tube-preparation, 8—12 ctgrs, 1 mm. lead-filter, twenty hours.

$17/2-1913$. Struma diminishing — the throat circumference now at the broadest 42 cm., diameter from below and upwards 11 cm. She feels less troubled, is still breathing with difficulty, but is better than before she commenced with radium treatment.

$11/4-13$. Tumour has diminished considerably, measuring from above and downwards — 9 cm. Throat circumference 42 cm.

During the continued treatment with radium the struma decreased so that in July 1914 it was hardly perceptible.



Fig. 1. Case I, B. B.
Before the radium treatment.



Fig. 2. Case I, B. B.
After the radium treatment.

On the other hand, by degrees, considerable atrophic and dilated vessels and telangiectasies had appeared on the front side of the throat owing to the continued dosages with radium (radium dermatitis). According to the experience we have now, the radium filter has been too weak. Instead of 1 mm. lead-filter, $1\frac{1}{2}$ to 2 mm. ought have been used.

Case II: G. S. A merchant's wife, 46 years old. At the age of about 15 to 16 the patient noticed that she grew thick in the front of the throat; the swelling of the throat increased in the course of the 16th year. She has suffered from palpitation of the heart and from nervousness, and from time to time from dyspnoea, when resting on the side. She objects to be operated upon.

Admitted to the radium institute on the $\frac{1}{12}$ —14.

St. pr. She is very lean and pale. Pulse 60. No fever. A tumour was observed stretching from manubrium sterni upwards to the hyoid bone and sideways to the back limbus of mm. sterno cleido-mastoid. Tumour consists apparently of 3 parts, one strongly prominent, large as a good-sized egg, in the centre line of the throat, and two other more diffuse, flatter and limited parts on each side. Tumour is covered all over with normal skin, which is movable over the tumour; the tumour is of a firm consistence, the surface smooth; the limit of the tumour to the sides is not acute, as it seems to shoot itself below mm. sterno cleido-mastoid. The centre part of tumour is movable from one side to the other, but not up and down; it moves together with the larynx when swallowing. The circumference of the throat 38 cm.

Treatment with radium from the $\frac{1}{12}$ —14 to the $\frac{15}{3}$ —16 in 7 sittings, tube-preparation, 12—16 ctgrs, 2 mm. lead-filter, twenty hours.

$\frac{25}{1}$ —15. Tumour has diminished as to size. Circumference of throat 36 cm.

$\frac{15}{3}$ —15. Is feeling better, less nervous, seldom heart palpitations. Is now able to rest on the side without suffering from dyspnoea.

$\frac{12}{3}$ —16. Declares to be much better. The tumour on the throat is smaller and softer; circumference of throat 35 cm.

$\frac{22}{1}$ —18. Still a change for the better. Feels well.

Case III: D. P. widow, 73 years old. 35 years ago she noticed a small tumour in the centre of the larynx. In the course of 15 years this had grown to that effect that the patient could not bend her head downwards; it being about the size of a great potato. In the course of the last ten years the tumour has been steadily increasing, especially out to the sides; last winter it has grown quickly. Suffers easily from dyspnoea when moving. Otherwise she is pretty well when keeping quiet.

Was admitted to the radium institute on the $\frac{4}{5}$ —14 for struma.

St. pr. A big tumour is observed on the foreside of the throat, which on the right side is stretching from the lateral ridge of m. trapezius downwards to clavicle, and which is less prominent on the left side. The tumour is of a firm, elastic consistence, it moves together with the larynx when swallowing. It is not sore. The tumour measures $15 + 12$ cm. in diameter; the pulse is 92, regular, feeble. The sounds of the heart are pure.

Treated with radium in 2 sittings from the $\frac{4}{5}$ —14 to the $\frac{2}{7}$ —14 16 ctgr. of radium (tube-preparation). I to $1\frac{1}{2}$ mm. lead-filter, twenty hours.

$\frac{30}{6}$ —14. The tumour is diminishing. She has now less dyspnoea when moving. Otherwise she is feeling well.

$\frac{16}{1}$ —18. The tumour still on the decline. She writes that she is in good health.

Case IV: A. L. S. A telephone worker's wife, 64 years old. Her present illness she noticed for the first time when 40 years old. She grew »thick» in the throat and from time she had some trouble when swallowing. The swelling turned out to be somewhat stationary until February this year, when it began to increase rapidly, especially on the left side. At the same time she had strongly pronounced trouble when swallowing, together with dyspnoea, this latter particularly when working. The patient was admitted to the Radium institute on the $\frac{3}{5}$ —20, the surgeon having declared the tumour inoperable.

St. pr. $\frac{3}{5}$ —20. The patient is in good condition. Pulse 68. Respiration 24, not oppressed, regular. Lungs and heart in normal condition. No exophthalmia; no tremor.

On the foreside of the throat in the thyroid region a tumour about the size of a clenched fist is observed — of gl. thyroid configuration, of a firm elastic consistence, constituting 2 visibly separated parts, left and right lobe. The left lobe is considerably larger than the right one, about 12 cm. long and 8 cm. broad reaching outward to the lateral ridge of m. sternocleido mastoid, and seems to disappear below clavícula. Upwards both the lobes reach an horizontal line through os hyoideum. The left lobe has a considerably more compact consistence than the right one.

Radium treatment in 7 sittings from the $\frac{3}{5}$ —20 to the $\frac{3}{6}$ —21. On an average 10 ctgrs. radium in tubes of 2 to 3 m.m. lead were applied to the tumour.

While treated with radium the tumour was reduced little by little as well as the swallowing inconveniences and the dyspnoea.

$\frac{9}{12}$ —20. The left lobe has now been reduced to 8 + 10 cm. and the right lobe is as a pigeon egg. No dyspnoea, less swallowing inconveniences. When she came to the hospital she could not lie down owing to the dyspnoea, but had to sit in bed. Now she can lie down in a regular way.

$\frac{1}{6}$ —21. The dyspnoea and swallowing trouble have now disappeared. She is well. The struma is still there, but considerably inferior to what was noted on the $\frac{9}{12}$ —20.

Toxic goiter. 8 cases

1 cured, 5 improved, 1 not improved

Cured (1 case)

Case I. M. H. Lady telegraphist, unmarried, 36 years old. Formerly in good health. During the spring 1909 she began to get »hot» and perspired much, became nervous and shaky in the hand, often heart palpitation. Got better under medical care. In the summer 1911 she got erysipelas in her face and after this illness her earlier symptoms reappeared again and since they have been steadily increasing.

In November 1912 struma was established. She suffers often from diarrhoea. Admitted to the Radium institute on the $\frac{19}{5}$ —13.

St. pr. The patient is in good condition; looks nervous, tears easily come into her eyes and she has trembling hands. Græfes. symptoms + exophthalmia. Pulse 110, regular, somewhat strained. On both sides of the larynx a swelling of the throat is observed; on palpation a tumour about the size of half an apple is

located on each side; even surface, strained, elastic consistence, not sore. Throat circumference 37.5 cm. Above the heart a light blowing by-sound is heard at apex.

Radium treatment from the $19/5-13$ to the $16/5-14$ in 8 sittings, alternating tube-preparation, 6—8 ctgrs and surface-preparation; 1 mm. lead-filter, twenty hours.

$5/7-13$. The patient feels already much better; the state of mind is more settled and she has less palpitations. Exophthalmia less prominent.

$2/8-13$. Still improving. No diarrhoea in the course of the last 3 weeks.

$17/10-13$. Throat circumference 35 cm. Pulse 100. Feels quite well. Alvus in order, sleeps well.

$28/3-14$. Pulse 88. Is doing quite well. $2/7-14$. Throat circumference 35 cm. Less exophthalmia. Is going on well. $5/11-14$. The throat has now its normal appearance. In good health. $5/6-18$. Writing that she feels quite well.

Improved (6 cases)

J. I. Workman's wife, 36 years old. Has been suffering from heart palpitation of late years. In April 1912 she observed her present disease. She got weak, perspired much, took easily to crying, lost her appetite and slept badly; at the same time she observed that her eyes »stood forward in her head» and that she grew thick about the throat. Occasional vomitings. Often diarrhoea. Admitted to the Radium institute on the $18/5-13$.

St. pr. The patient somewhat lean; strong exophthalmia, some injection in the face. Tremor in the hands. Græfes + Pulse 116. The heart sounds clean.

On both sides of the larynx a firm tumour, about the size of an egg, well bounded, with even surface and displaceable from one side to the other is located; not adherent to the skin, not sore. Circumference of throat 32.5 cm.

Treated with radium from the $21/5-13$ to the $7/9-13$ in 3 sittings (tube-preparation) 10 to 12 ctgr. radium, 1 to 2 mm. lead, twenty hours. $12/7-13$. The patient feels much better and is quieter; the diarrhoea abated. Is not nervous. Throat circumference 32 cm. Pulse 100. Exophthalmia almost unchanged.

$11/5-15$. (Letter) Owing to her economy she could not continue with the radium treatment. Says that she is better; the struma has diminished, but the eyes are about the same.

Besides the above-mentioned two cases of toxid goiter there have been treated 4 cases of pronounced toxid goiter at the Radium institute. The treatment has with reference to two of the cases extended over a period of one year, in these cases good improvement was obtained; as to the other two cases the treatment was discontinued after the lapse of 3 months. Also in these cases an improvement was noted, but the patients living far away from Christiania could for economical reasons not continue the radium treatment.

The radium treatment had in all the cases a decidedly favorable influence on the general health; the sleep and the appetite improved, the state of mind became more quiet. The pulse beat slower and the struma was reduced. Least influence was noted in the treatment of exophthalmia with radium.

Struma malignum. 8 cases

(5 cases temporarily improved. 3 cases not improved)

Cases temporarily improved (5 cases)

Case 1. K. K. A labourer's wife, 71 years old. Has been somewhat hoarse for about 5 years; it is alleged that she has not had struma. About Easter of the present year a tumour appeared at the front of the neck; six weeks later a perforation occurred and since then matter has run from the opening. Of late there have been pains on swallowing as well as spontaneous pains in the throat. The hoarseness has increased. She is troubled by dyspnoea and has lost weight considerably. Transferred to radium department from surgical section. B. as suffering from struma cancrorum. ($^{21}/_8-13$).

Condition. Cachectic appearance; hoarse voice. The entire portion of the throat corresponding to pomum Adami is occupied by an infiltrating tumour, as hard as cartilage and quite as large as an orange. The edges are covered by granulations and are deflected outwards in the form of a crown. The centre is occupied by a cavity.



Fig. 3.
Case 1. K. K. Before radium treatment.



Fig. 4.
Case 1. After radium treatment.

Radium treatment from $^{21}/_8-13$ to $^{27}/_8-13$. Tube preparation 4 cgrms of radium, $^{1}/_{10}$ mm. lead filter 24 hours inside the cancerous cavity. 18 cgrms radium (tube preparation) 1 mm. lead 20 hours over the tumour.

$^{22}/_{10}-13$. A contracted cicatrix is seen in the middle of the neck.

The cicatrix is firmly adherent to the larynx and somewhat thickened. No glandular tumours in the neck. Hoarseness has practically disappeared. Patient looks well, has a good appetite, and is in good vigour.

$^{20}/_{13}-13$. Free from symptoms.

$^{11}/_4$ —14. The patient returned. An infiltration had developed in the region around the old ulcer at the front of the throat; general condition again poor. Swallowing difficult.

She has not visited the institute subsequently. (Letter unanswered).

Case II: M. A. K. The wife of a brewery workman, 54 years of age. In September 1911 she was operated for strumous cancer the size of an apple. Was subsequently well until the winter when a tumour again developed at the front of the neck. At the same time breathing became difficult. Has lost in weight of late. Admitted to radium department on $^{25}/_4$ —14.

Condition: In front of the throat extending from fossa jugularis and upwards to above the larynx an uneven, projecting, firm, immovable tumour is seen, about as large as an orange; the tumour is adherent to the larynx and the trachea. The skin over the tumour is mostly displaceable. The patient is hoarse and respiration is audible.

Radium treatment from the $^{24}/_5$ —14 to $^{21}/_8$ —14, 3 series (12—16 cgrms of radium), with tube preparations, 1 mm. lead filter, 20 hours.

$^{27}/_6$ —14. Tumour receding; hoarseness diminished.

$^{28}/_8$ —14. Tumour diminished to about one half of its former size, and feeling softer. Hoarseness and difficulty in breathing have both diminished. — Patient subsequently did not reappear for radium treatment.

Case III: L. O. H., a sailor's wife, 75 years of age. 12 years before admission the patient noticed a small «ball» just above the jugulum. It remained about the same size until 3 years ago when it began to grow slowly. During the last year the tumour has grown rapidly. Her voice has grown hoarse and sometimes food enters the wrong passage. Transferred on $^{5}/_5$ —15 to the radium department from surgical section B. for struma malignum.

Condition. Appearance good. Physical condition without remark. Voice hoarse. In the neck, corresponding to the position of gl. thyroidea, a tumour, almost as large as an orange, is observed, extending up to the margin of the sterno-cleido-muscle on both sides. The tumour is firm, and moves only very slightly when the patient swallows. The skin is displaceable over the tumour.

Radium treatment from $^{5}/_5$ —15 to $^{30}/_3$ —16, 6 sittings. Tube preparation; 12—16 ctgrs, 2 mm. lead; 24 hours on each place.

$^{27}/_6$ —15. Tumour has diminished to about one half of its former size; hoarseness less. $^{16}/_{12}$ —16. Hoarseness almost gone; the tumour practically unchanged since the $^{27}/_3$ —16. Patient feels well. $^{26}/_2$ —18. The tumour is now as large as a goose's egg. The skin over it is atrophic and wrinkled with numerous telangiectases but completely unbroken. The patient feels well. No dyspnoea or hoarseness.

Case IV: A. S., a farm labourer's wife, 54 years of age. Her present illness did not commence until just before Christmas 1916, when she noticed a tumour on her neck. At first it was small and soft but later on it grew steadily and became firmer. The patient easily gets out of breath, and easily becomes nervous and frightened. Was admitted to the surgical section B.

Condition. $^{10}/_2$ —17. The tumour is situated in the lower and anterior part of the neck, with an enlarged side flap projecting downwards towards the right. The tumour is as large as a man's fist, is movable on palpation, and hard in consistency. The tumour moves with the pulse beat of the carotid artery. The skin over the tumour is movable and of normal appearance.

$^{10}/_2-17$. Under local anæsthetic 6 cgrms of radium ($1/2$ mm. lead filter) were applied in three tubes inside the cervical tumour.

$^{20}/_2-17$. The tumour is now the size of a pigeon's egg, and lies in front of the larynx like a flat cake; it follows the movements of the larynx in swallowing.

$^{24}/_2-17$. 14 cgrms externally on the neck over the tumour. (2 mm. lead filter) 24 hours.

$^{8}/_3-17$. During the past week a glandular abscess has appeared in the left axilla, which two days ago perforated, thick yellowish matter escaping.

$^{11}/_4-17$. The glandular abscess in the left axilla has disappeared. At the anterior part of the neck there only remains a flat tumour about as large as a six-penny piece. — Radium treatment externally on neck from $^{6}/_3-17$ to $^{7}/_3-17$, (8 cgrms of radium, 24 hours, 2 mm. lead filter, $^{21}/_4-17-^{25}/_4-17$, (6 cgrms of radium 24 hours) and $^{24}/_6-1917$, (3 cgrms of radium, 24 hours).

$^{22}/_6-1917$. There is now no tumour palpable in the neck. Patient states that her state of health is perfectly satisfactory. No glandular tumour. $^{21}/_1-18$. Free from symptoms.

$^{22}/_3-19$. Free from relapse.

Summary

In the Radium Institute of the Rikshospital 24 cases of goiter where of 8 of pronounced toxic goiter and 8 of plain goiter without toxic symptoms or with milder nervous symptoms and 8 cases of inoperable struma malignum have been treated with radium since 1913.

The 8 cases of plain goiter have been partly serious cases. In all of them the goiter has diminished during radium treatment. In 2 cases almost complete cure was achieved. In 6 cases a change for the better. With the patients that suffered from nervous symptoms these disappeared during the treatment.

For treatment with radium (eventually roentgen rays) these cases will be appropriate where, for some reason or other, operation cannot be undertaken or where operation is combined with great risk.

Of the 8 cases of toxic goiter 1 case was almost cured, 5 cases improved and 2 not improved. The radium treatment had an absolutely favourable influence on the general state of health and on the nervous symptoms. The sleep and appetite improved, the weight increased and the state of mind became more composed. The pulse calmed and the size of the goiter diminished. Least influence had the radium treatment on the exophthalmia.

Of the 8 cases of struma malignum treated with radium 5 were temporarily improved; in 3 cases radium had no good effect on the tumour.



On Plastic Means of Application in Radium Therapy

by

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(Continued)

6. The plastic Method of Application in the Case of Tumours of the Lips and the Cavity of the Mouth

The irradiation of these membranous regions, as has been pointed out by WICKHAM and DEGRAIS in their handbook, is rendered much more difficult not only by the biological properties of the mucous membrane itself, but also by causes of an exterior, »material» nature.

As such are to be mentioned first the great irritability of the oral mucous membrane, which is increased by speech, by movements of mastication, salivation, etc. The irritation is in part a mechanical result of the prolonged contact with the radium supporter, but the very painful radium dermatitis, in the proper sense, is still more important. To this must be added the difficulties arising from the organs themselves and their tumours, in consequence of their complicated outward form, which renders an exact application troublesome, and indeed often quite illusory. In the application to the various membranous regions here concerned the plastic substance can be used in a variety of ways, so that the versatility of the method is here displayed to an especial degree.

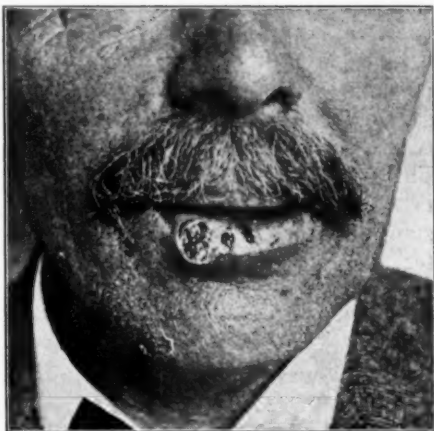


Fig. 25. Cancer of lip before treatment.

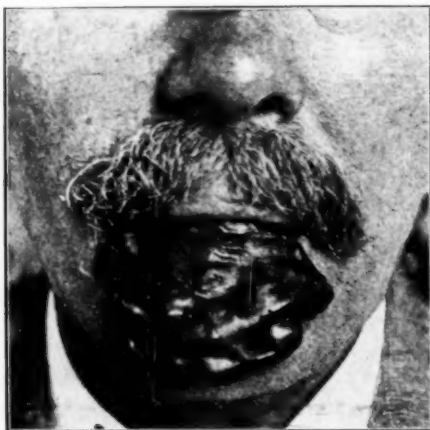


Fig. 26. Applicator for lip carcinoma attached.

and lead filter are applied to the upper surface, the impression of the tumour on the lower side of the applicator serving as a control. The lip-plate is then once more applied, and is fixed in position by means of fresh plastic substance inserted between the closed teeth. The upper lip is then drawn up by an assistant, in order to protect it from irradiation, the plastic substance being at the same time spread out over the tubes by way of a covering (fig. 25, 26).

The application *in situ* may with advantage be performed in the following way (BERVEN): — The under lip is pulled forwards by means of an S-shaped leaden plate, enveloped

Thus in *lip carcinoma* the method of application may be developed according to two different principles: on the one hand, by means of an applicator constructed beforehand, on the other by the erection of the applicative apparatus and attachment of the radium *in situ*.

The former method may for example be employed as follows: The under lip is pulled forwards, and an impression-plate is then modelled over lip and gingiva and is quickly cooled *in situ*. After the finger-marks have been smoothed away with a hot iron, radium



Fig. 27. Cancer of the under lip.



Fig. 28. The tumor of fig. 27 with a S-shaped leaden plate placed behind it.

in plastic substance, which serves both as a support and at the same time as a protection to the gingiva, the patient himself fixing the plate between the teeth. By means of a support placed on the chin the lip is then surrounded from below with plastic substance, which is connected with the applicator by means of bridges on both sides of the tumour. The tumour region thus left bare is now covered with plastic substance upon which the tubes are attached (preferably in cross-fire). The bandage should firmly fix the jaws with closed mouth (fig. 27—31).



Fig. 29. The exterior support against the chin.

The method can be used with almost the same facility independently of the situation and manner of growth of the tumour. Cases of relapse after a foregoing operation are less favourable since the lip is apt to grow tight, so that radium capsules and protective appliances have not sufficient room; moreover, on account of the cicatrization the process of healing does not seem to proceed so easily in such cases.

Since, however, the cosmetic and functional results of radium treatment in cases of lip cancer undoubtedly surpass those attained by the surgical me-



Fig. 30. Roentgenogram of the complete applicator.



Fig. 31. The tumor of fig. 27 cured 5 weeks after radium treatment.

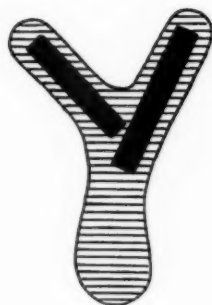


Fig. 32.

thod, we should henceforth be justified in allowing the former to have the preference in the treatment of these tumours, a good control and suitable technique being naturally presupposed.

In the *lip angiomas* which are of such frequent occurrence, especially in children, the plastic method is of equal practical value, but its carrying out is simpler, since the irradiations are shorter and do not require such extensive protective appliances as in the case of cancer. I

usually content myself with fixing a suitable quantity of plastic substance between the teeth, stretching out the lip and spreading the substance into a layer of the thickness of about 1 mm., and after cooling placing the radium on this for 1—1½ hours. With profound angiomas the secondary filter layer is made somewhat thicker (3—4 mm.), and I often add a lead filter 1 mm. thick and a lead protector for the other lip.

With little children this process cannot be adopted, since the children cannot bear the taking of the cast with warm plastic substance. I therefore generally enclose the radium plates in plastic



Fig. 33. The framework of the applicator in vestibulum oris.

compound, if necessary so that they grip the lip from both sides, in such a way that cross-fire treatment is the result (see fig. 32). The substance is formed into a handle with which the mother applies the radium by gentle pressure against the lip.

The application of radium to *buccal tumours* is a matter of much greater difficulty, not only on account of the soft consistency of the bucca and the usually great extent of the tumours, but also because of the difficulty of finding room for radium preparation, filters, and protective appliances in the often narrow space between the tumour and the alveolar process.

With tumours which have not caused infiltration of the soft parts of the cheek the radium tubes — if necessary, provided with filters — may simply be attached to a protective plate of lead and provided with a secondary-filter layer of plastic substance 2—3 mm. thick, the apparatus being fixed between the teeth by means of the same material. Another method, given by BERVEN, which I have tried with success, consists in filling the bucca with soft plastic substance, in the middle of which a hollow is made with the finger; after cooling with cold water the radium preparation is laid in this hollow against the bucca, and the rest is filled up with plastic substance. Fixation between the teeth as in the former case (figs 33, 34).

This method of procedure, however, does not allow sufficient protection for jaws and tongue in the application of larger quantities of radium, since it is difficult to introduce lead protectors of the requisite dimensions. In such cases I have, therefore, proceeded in the following manner: — The radium is applied to the bucca upon a lead-filter plate 1—2 mm. thick, covered with



Fig. 34. The complete applicator; the angioma of the cheek under cross fire.

plastic substance, and the bucca is distended to its utmost capacity with the finger. There is then introduced a similarly covered leaden protective plate 3—4 mm. thick, which is fixed between the teeth by means of the mass. Finally, the intervening space is filled entirely with plastic compound which must be allowed to harden *in situ*, if necessary with open mouth.

However, the results of the treatment of buccal tumours show that these, as soon as they infiltrate to any great extent into deeper tissues in the bucca, are not very suitable for radium treatment. In many cases they are not completely cured, but there is only substituted for the tumour a hard, coriaceous induration, which by degrees passes over into necrosis. Sometimes after primary epithelisation of the tumour there also arises a secondary deep necrosis, which is not seldom followed by perforation and gangrene of the cheek. According to BERVEN's researches this bad result is to be explained by the unusually infiltrating manner of growth of buccal cancer, so that the tumour destroys the fundamental tissues, and these have much smaller possibilities of nutrition and regeneration than the lips. A future development of the technique may perhaps improve the present poor prognosis in the case of these tumours (emanation tubes!).

With tumours of *the jaws and the hard palate* the radium application which formerly presented very considerable difficulties, can be performed comparatively simply and easily by the plastic method. With *palatal* tumours it is best to take a complete impression, including also the alveolar processes of the upper jaw (preferably in a recumbent position). When the required thickness has been given to the mouth-plate, the radium and filters are placed on the under side of the latter. The plate is then introduced, and underneath it are moulded down first an extension of plastic substance, which fixes the plate against the lower jaw, and also a thick leaden plate, if possible provided with an extra pellet of plastic substance, designed to press down the tongue and as far as possible protect it from radiation. With the same object in view it is wise to fix the apparatus with open mouth. A firm bandage holds up the lower jaw.

With tumours of *the upper and lower jaw* the principles of application are the same, if no surgical operation has preceded the radium treatment. In consequence of the shape of the jaws these tumours can usually be treated *au feu croisé* by the preparation of a complete cast which should include at least the whole side of the jaw in which the tumour is situated. When the cast has been withdrawn the radium is applied, with filter if necessary, and the apparatus is replaced. As a means of protection against irradiation of the tongue and buccal mucous membrane

may be used either the protective means described above, (see buccal tumours) or preferably thick plates of lead, separately introduced, enveloped in plastic substance. If the patient has no teeth, the cast must usually be made to include both upper and lower jaw. As a rule it is necessary to fix the apparatus with open mouth, in order to obtain sufficient room; fixation can be assisted by allowing the substance to run out in the form of a plate upon the outside of the cheek.

If the patient has previously undergone resection of the upper jaw, the method of procedure will vary considerably. The large resection cavity, communicating widely with the mouth, the walls of which may possibly show remains of the tumour or signs of relapse, must be covered with a layer of plastic material which will give support to the radium tubes. As a protection for the cavity of the mouth a mouth-plate with a thick plate of lead is applied, after which a prothesis of plastic substance is inserted in the place of the alveolar process as a support against the lower jaw (fig. 35). All this is best performed



Fig. 35. Applicator for maxillary cancer, after resection, from before.

with the patient in a recumbent position with head bent backwards; only for the cooling process (by washing out with cold water) will the patient be raised into a sitting position.

Tumours of the palate and jaws should be irradiated with caution, since there is a decided tendency to the formation of necrosis with consequent protracted and often painful osteitis. The narrowness of the therapeutic limits of the irradiation in these cases is probably to be explained through the anatomical conditions, since the soft parts of the regions in question are spread out in a thin layer over large but equally thin bony parts. It is very possible that the circulation here is not adequate to the task of producing the necessary regeneration after the effects of the radium.

In all radiations in the cavity of the mouth it is therefore absolutely necessary to apply adequate lead protectors, and to try to diminish the danger of burning by increasing the distance of the radium. Matters

should be so arranged that repeated treatment is as far as possible avoided.

The same degree of caution is necessary in regard to the inflammatory irritation of the masticatory muscles which not seldom arises after radium treatment and which, either directly or by secondary shrinking, may involve lock-jaw. By this both the nutrition of the patient and the continuance of the radium treatment will be rendered difficult — a doubly disastrous complication.

Finally, a few words upon the plastic method of application with *tumours of the tongue*.

The characteristic properties of the tongue — its soft consistency, its great mobility and incessant changes of form make it as a rule impossible to take an impression of lingual tumours in the usual way. That would only be successful with very large, hard, and fixed tumours, which are not too tender to the touch.

Efforts should be made instead to fix the applicator on the alveolar process with suitable protective appliances and focal distance, the tongue being pushed to the other side, adapting itself by virtue of its flexibility to the form of the apparatus, and being as far as possible restrained in its mobility by the latter. In doing so care should in every case be taken that too great discomfort is not caused the patient. In other respects the method of procedure must be adapted to the position of the tumour.

If the tumour is situated *on the top surface of the tongue*, we have only to apply a lead-filter plate, embedded in plastic substance, right over the tongue and fix it between the teeth. The radium can then be attached over the place of the tumour. If the patient has no teeth, a substitute for these must be formed by projections of plastic substance, fixed between the alveolar processes. A thick lead protector should be placed against the palate.

Should the tumour lie *on the edge of the tongue*, or on its lateral surface, the method described above can be employed if between jaw and tongue a »protective drum» is applied, on the inner wall of which the radium is fastened and which can be made so as to bend round over the edge of the tongue in order to secure cross-fire treatment.

This method is not suitable if the tumour is situated far back, near the glossopalatine fold, since here there is not sufficient space and it is easy to induce vomiting reflexes by pressure from the applicator. We usually succeed better by letting an assistant fix the tongue to the side not affected and then building up the applicator *in situ* bit by bit. When the foundation-plate and the radium tubes have been applied, the intervening space should be filled up, as a protection to the lower jaw,

with plastic substance in which a thick leaden plate is embedded, whereupon the palate is protected in the same way by a leaden plate fixed between the teeth. If necessary, a lead-filter can be applied in a similar way for the irradiation of the tongue from the back.

Finally, in cases where the tumour has grown backwards, along the root of the tongue, or upwards, infiltrating the tonsillar region, the application is often difficult. Sometimes we succeed best by using the instrument shaped like a pair of tongs, invented by BERVEN (see the tonsillar tumours, p. 230). If the patient cannot bear this, we may try — if necessary after previous cocainisation of the tumour area — to make a cast of the area, adding an extension running back over the root of the tongue. The radium tubes are applied, a catheter is introduced through the nose (this can at the same time be used for the application of radium) and is welded down on to the applicator by means of plastic substance. Finally, the apparatus is also fixed from the front by means of plastic compound between the teeth.

With tumours of the tongue the prognosis for radium treatment is relatively good, if only large doses are used, concentrated within a comparatively short time.

The feeling of thirst that is caused the patient by most applications in the cavity of the mouth may be mitigated by inserting in the applicator a glass tube through which water can be sucked up (BERVEN). The drying of the mucous membrane of the lips can be prevented by smearing with vaseline or paraffin. The often very painful radium reaction can be lessened by repeated rinsing of the cavity of the mouth with warm gruel.

7. The plastic Method of Application with Tumours in the upper Air-passages (including the Palatine Arches and Tonsils)

Tumours growing in the back and upper parts of *the nasal cavity* are hardly accessible to the plastic application of radium: here it is more convenient and suitable to employ the fixation by means of tamponade recommended by ALBANUS, or else to introduce the radium by means of a catheter.

In the front part of the nasal cavity, on the other hand, the plastic substance offers an convenient means of fixing the radium, the tubes being simply embedded in a tap-shaped applicator of plastic substance which is inserted into the nasal cavity — with larger ulcerating tumours the walls of the cavity should first be coated with plastic substance and the radium applied afterwards — and is then kept in place by means of an outer extension around the nose.

Again, in regard to tumours in the air sinuses of the nose, those which proceed from the maxillary antrum are probably the most common. If in such cases resection of the upper jaw is possible, there is, of course, no doubt that this is certainly indicated as the proper method of treatment, and the treatment with radium should not come into question until after the operation. The method to be adopted in irradiations of this kind has already been described (see above, tumours of the upper jaw, p. 225).

But where resection is impossible the best way is probably to apply the radium directly in the cavity by means of an opening made in the fossa canina. This trepanation should be made so large that the radium tubes can without difficulty be introduced and exactly fitted into position. For this latter purpose plastic substance can be used if the opening is wide enough, otherwise tamponade must be resorted to. The radium tubes employed for this purpose must be small but powerful, and care should be taken to apply enough secondary filter and make use of sufficient distance of irradiation,¹ as the case may be, since otherwise necrosis of the bone, or perhaps serious injuries to the eye and its muscles, may easily arise.

The inner irradiation has in many cases to be completed by cross-fire treatment from without, in which the radium may be most suitably applied by means of plastic substance according to the principles laid down for external tumours.



Fig. 36. Skeleton diagram of applicator for tumours of nasopharynx.

Quite a special method of application is demanded by the tumours growing in the *nasopharynx*. In this inaccessible portion of the respiratory passages we can obviously not avail ourselves of direct plastic impressions, but nevertheless the plastic compound may with great profit be used here also. An excellent method of application, first given by BERVEN, is the following: — After palpation of the nasopharynx a slice-shaped, convex-concave applicator of plastic substance is prepared, which is adapted to the shape of the cavity and contains within it the radium tubes arranged transversally, provided on the dorsal side with a lead filter and on the front concave side separated from the soft palate by a thick protective plate of lead. In the application

the apparatus is attached to a catheter introduced through the nose, and is drawn from the cavity of the mouth up into the epipharynx. A thread

¹ At least 5 mm.

fastened to the lower end of the applicator leads up through the nose and serves to stretch its back surface against the tumour, another thread passes out through the mouth and is used for withdrawing the apparatus.

In cases where, on account of the size of the tumour, the nasopharynx

does not permit the use of so large an applicator, I usually begin the treatment by introducing radium in a catheter through the nose. Another method is by means of plastic substance to set a powerful radium tube, provided with a lead filter, vertically on the end of a wooden spatula, which



Fig. 37. Introduction of applicator into nasopharynx.

is then introduced through the mouth, so that the radium is pressed up into the nasopharynx. The apparatus is finally fixed by means of a firm layer of plastic substance held between the teeth. Care must here be taken that the patient can breathe freely through the mouth, since breathing through the nose has been made impossible (fig. 38).

If the sarcomas of the epipharynx come under treatment sufficiently early, the prognosis in general seems to be good, the majority of cases being clinically cured.

Finally, I find it convenient in this connexion to treat of the radium application in the case of tumours proceeding from *the tonsils* or the *soft palate*, and more or less obtruding *the entrance to the pharynx*.

We have here to do with quite different anatomical conditions from those of the foregoing groups, since these tumours grow on a relatively

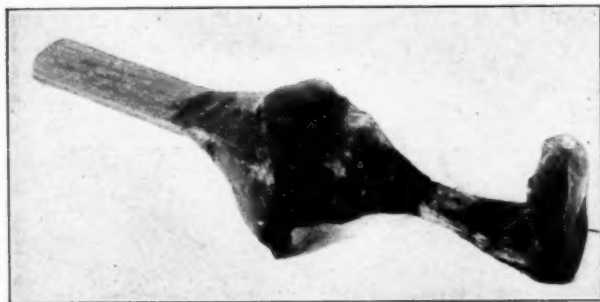


Fig. 38. Applicator for tumours of nasopharynx, fixed on wooden spatula.



Fig. 39. Tong-shaped instrument for treating tumours of pharynx.

smooth surface of mucous membrane, with soft folds which do not offer any appreciable support for an applicator: moreover, our task in this region is rendered much more difficult by reason of the vomiting reflexes which often appear on the

slightest touching of the sensitive mucous membrane.

These difficulties are often extremely well avoided by BERNEN'S method of applying the radium under *firm pressure*, so that the vomiting reflexes are for the most part suppressed and the displacing of the prepate is prevented. This is done by applying the radium by means of plastic substance on to one branch of a specially constructed instrument shaped like a pair of tongs, the plastic substance being adapted by hand to the shape of the tumour or a direct impression being used. On the insertion of the apparatus cocaineisation is sometimes necessary, but afterwards it can be borne without too great inconvenience. The outer arm of the instrument is padded with cotton and applied behind the lower jaw to the side of the neck, whereupon the instrument is locked and is further fixed by being moulded down between the teeth by means of plastic substance, and also by a firm bandage. Applications of from 15 to 20 hours can in this way be borne well.

If the tumour is so large that the pharynx is entirely stopped up, the above method can not, as a rule, be employed. In such cases it is best first to try to reduce the size of the tumour by X-ray treatment. If, on account of the situation of the tumour in the soft palate, the tongs are not suitable, I recommend the following expedient.

With the patient in a supine position an applicator is formed giving an impression of the tumour and of the teeth of the upper jaw, and on to this are attached in a suitable fashion the radium and the filters and a thick protective plate for the tongue. This apparatus will then usually fill the whole of the isthmus faucium. In order to make breathing possible there should be fitted into the under side a wide tracheal tube, after which the apparatus can be inserted and fixed against the lower jaw by laying plastic substance over it. With this method we have arrived at the desired result in one case which presented extremely great technical difficulties of treatment.

If the patient for any reason cannot endure the tweezers, one may try to mould an applicator along the affected side of the pharynx, afterwards applying radium and tongue-protector and attaching the inner end of the apparatus to a catheter introduced through the nose (fig. 41).

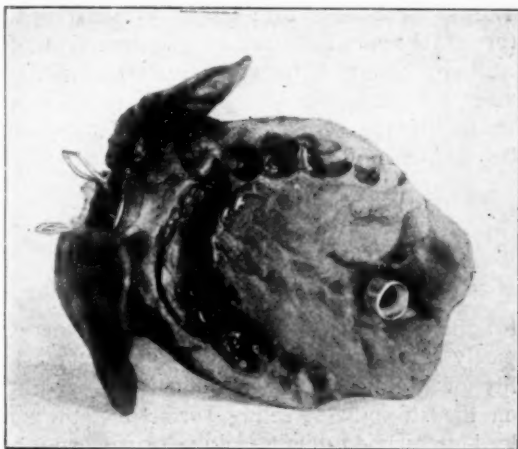


Fig. 40. Applicator for tonsillar tumour, moulded around tracheal tube.



Fig. 41. Back part of applicator for tonsillar tumour with catheter for introduction through nose.

The application is completed by attaching the outer part of the apparatus (preferably strengthened by the insertion of a leaden plate) to the front teeth by means of plastic substance. This method is sometimes a valuable substitute for the application by means of the tongs. As to the result of the radium treatment of these tumours, the same thing may be said as about the tumours of the nasopharynx.

8. The plastic Method of Application with Tumours of the Penis

The application of the radium preparations to these tumours according to the methods hitherto in use has been an extremely ticklish matter, partly on account of the soft, loose consistency of the penis, the mobility of its skin, and the difficulty of getting the plasters to stick firmly on the strongly secreting surfaces of the tumour, as well as of modelling lead-filters upon this sensitive organ, and partly also on account of the nearness to the scrotum, which demands an absolutely certain protection against irradiation.

The plastic method of application affords the possibility of solving these problems in a remarkably simple fashion.



Fig. 42. Applicator for cancer of penis. Inguinal plate and cylindrical covering, strengthened by lead plates.

The principles on which I have proceeded are the following. — The patient takes up a supine position with legs somewhat abducted. A loop of plaster is fastened on to two opposite sides of the glans or the shaft of the penis: this serves, with the help of an assistant, to fix the penis in a vertical position.

The pubes hair is shaved off or is completely covered by a surgical bandage tightly wrapped round the hips, which can afterwards be used as a support for the applicator. The latter consists of a large foundation-plate of plastic compound, laid like a broad collar around the root of the penis, and provided with a thick

leaden protective plate for the testicles. Then around the vertically held body of the penis is moulded a cylindrical covering which reaches down to the proximal edge of the tumour and fixes the organ in this position, if necessary with the aid of lead plates as supports.

Now the loop of plaster is cut away, and the radium tubes, if necessary with lead-filters, are applied over the tumour on to a secondary filter of plastic substance, which is directly connected with the above-mentioned covering. The position of the radium thus becomes exactly fixed, and the firm covering prevents the penis from sinking together or the tubes from being displaced from the surface of the tumour. On the tumour cross-fire treatment can be secured without difficulty.

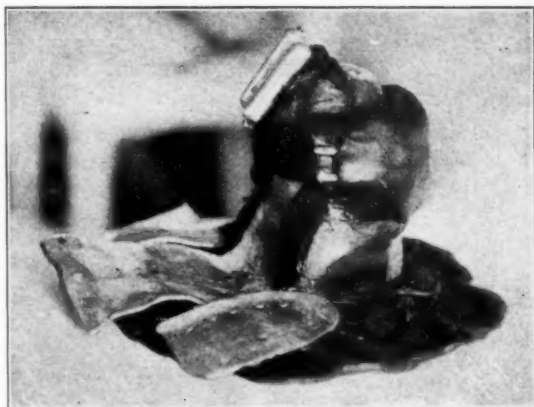


Fig. 43. Applicator for cancer of penis. Secondary filters, radium tubes and protection lead plates applied.

Finally, over the radium is attached a protective layer of plastic substance which at the urethral orifice should be moulded so as to form a channel, designed for carrying off the urine.¹ Fixation by means of another bandage round the hips.

Owing to the vertical position of the penis, the radium is removed as far as possible from the scrotum, so that the protection to the testicles is increased. The method is free from pain and does not seem to involve any appreciable discomfort for the patients, who can quite well bear irradiations of 24 hours at a stretch.

9. The plastic Method of Application with rectal Tumours

In spite of the fact that of all the divisions of the intestinal canal the rectum is incomparably the easiest to get at, the application of radium here has, hitherto, none the less presented considerable difficulties, since it has not been possible to satisfactorily adapt the position of the radium

¹ If the patient cannot urinate in a lying position, a catheter à demeure should be introduced before the application of radium.

preparations to the different shapes of the tumours nor yet to find reliable expedients for regulating the distance of irradiation or for fixing the radium steadily in its position.

Previous dilatation of the sphincter is often necessary in order to

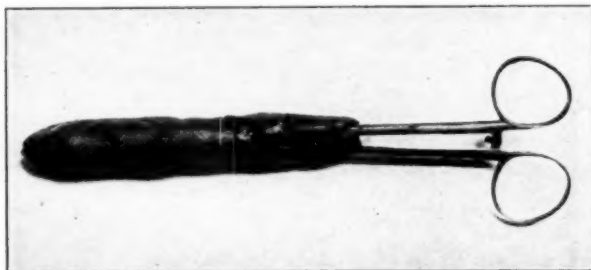


Fig. 44. Tweezers with cylindrical applicator for circular cancer of rectum.

render the tumour convenient of access. Further, it should on principle be recommended that a colostomy be made before the irradiation, so that the tumour area is not soiled and the radium possibly displaced by the pressing down of the faeces. The subsequent radium

reaction will also by this means be associated with less discomfort for the patient, since defaecation with its accompanying irritation is avoided.

By means of the plastic substance it is comparatively easy to ensure an exact and certain application of radium and filters.

With *discoid* tumours localised at one wall of the rectum it is probably best, after accurate palpation, to prepare a suitable applicator of plastic substance, and provide it with a thick leaden protection for the unaffected side of the intestine as well as with an extra layer of plastic substance outside this, so as to keep the healthy parts as far away from the radium as possible. An apparatus of this kind is of considerable breadth and will probably in most cases require narcosis and dilatation of the sphincter for its introduction. It can be fixed in position by means of an extension through the anus, which is spread out on and attached to the skin (BERVEN). Probably, however, it is safest to support this extension by an embedded core of metal (e. g. a pair of tongs), since otherwise there is a danger of its softening and being destroyed through the pressure of the muscle.

Again, when a *circular* rectal cancer, of polypous or solid growth, appears, it is convenient to shape the applicator like a cylinder with the radium capsule lying in a central position, and to place round the latter a filter capsule, into one end of which a pair of tweezers is fitted. The whole is enveloped in a layer of plastic substance from 0.8 to 1 cm. thick. A cigar-shaped appliance of this kind can usually be introduced without great discomfort; it may be secured by welding

down between the nates a plug of plastic substance entirely surrounding and fixing the tongs. Further, by a bandage, tightly applied.

By means of this method of application it is now and then possible considerably to reduce, or even to bring to complete resorption, not too large tumours. The process, however, is sometimes complicated by severe radium reactions with discharges of mucus and blood, and with extremely painful contractions which may bring the patient almost to a state of desperation and which to a great extent reduce the therapeutic value of radium treatment with application in the rectum. This seems to apply specially to such tumours as are situated in the immediate neighbourhood of the sphincter. Probably, therefore, in such cases we ought to restrict the radium treatment to the greatest possible extent, and combine it with powerful X-ray deep therapy.

10. The plastic Method of Application with Tumours in the female Genitalia

For *intra-uterine* or *intracervical* application the plastic substance is not suitable, but, on the other hand, I have had great use from it in certain cases for the fixation of the radium against vaginal tumours and tumours of the portio. This applies both to vaginal carcinoma proper and also to tumours of the cervix with main localisation in the portio and fornix.

When the cervical canal is preserved, I therefore use now as before cylindrical lead-filter capsules 2 mm. thick with rubber filters of the thickness of 1 mm. If the *cervix* is *destroyed* and its place is taken by a wide *tumour-crater*, I have usually formed, in accordance with the shape of the crater, applicators of plastic substance in which I have embedded the radium capsule and which have, therefore, shown good powers of adaptation to the individual tumour. Finally, with *tumours of the portio*, more or less filling up the fornix, I generally use applicators constructed in the following way. A round leaden plate, 3—4 mm. thick and of suitable diameter, is coated with plastic substance

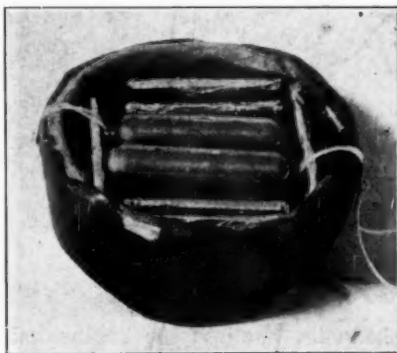


Fig. 45. Bowl-shaped applicator for treatment of cancer of portio. Secondary filter taken away to show radium tubes.

and surrounded with a leaden edge of the same thickness and 1 cm. in height, designed to protect the vaginal walls. Into the bowl thus formed the radium is placed — the exact manipulations being adapted to the different shapes and sizes of the various tumours — together



Fig. 46. Applicator for cancer of left labium minus, first stage; right labium pressed aside by layer of compound.

with a lead-filter at least 2 mm. thick, not counting the wall of the radium-tube itself. The whole is covered with a secondary filter of plastic substance 5—10 mm. in depth. Finally, on the under side of the apparatus is applied an extra layer of plastic substance, the thickness of which is adapted to the width of the vaginal opening and which serves to keep the vaginal walls still farther away from the radium.

After careful greasing, the applicator (which therefore has a hemispherical or somewhat more flattened shape) is pushed

edgewise into the vagina, after which a flat speculum is introduced and the apparatus is brought into its right position either by hand or with the aid of a pair of tweezers. In so doing, great help is derived from a couple of silken threads embedded in the plastic substance, which can afterwards be used for drawing out the applicator. By means of special marks on the surface of the latter we can test whether the radium lies in the desired position in relation to the tumour. The apparatus is finally fixed by means of firm tamponade.

The advantage of this method is that the radium capsules maintain their proper position in relation to one another and to the tumour with

more certainty than if tamponade is employed, and that the focal distance during the whole irradiation remains absolutely undisturbed. Certainly these applicators are heavy and sometimes rather difficult to introduce, but, as opposed to the leaden pessaries constructed by certain German gynaecologists, they have the advantage of enabling form and size to be adapted to the individual conditions. For this reason they ought also to be preferred to the colpeurynters recommended by DÖDERLEIN, which are, moreover, of rather delicate material and may break during the irradiation. On the other hand, it is undoubtedly a disadvantage that we here lack the possibility of control over the position of the separate radium tubes in relation to the tumour which is given with the fixation by means of tamponade.

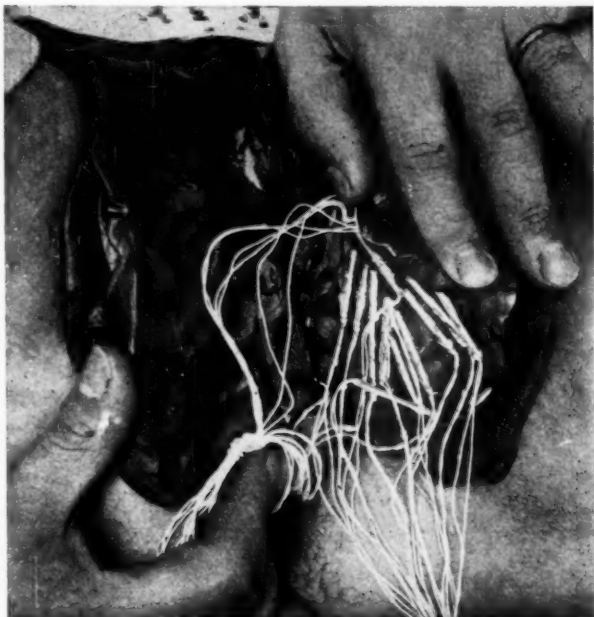


Fig. 47. Applicator for vulvar cancer, second stage; both labia held apart by layers of compound. Radium tubes and lead filter over tumour area.

There is no objection to using the same plastic material for the purpose described on several occasions, since the process of sterilisation related above easily removes most of the bad smell from decomposing cancerous tissue. This remark is made in opposition to v. SEUFFERT'S condemnation of a similar use of wax material according to BAISCH.

With tumours of the cervix, which have to a great extent *infiltrated the vaginal walls*, as also with *genuine vaginal carcinoma*, I have in certain cases profitably used plastic applicators, either adapted by hand to the shape of the vaginal wall or else made solid, in the shape of a cigar, filling up all the vaginal lumen and having the radium placed centrally. In one case, where the tumour lay far back towards the front wall of the rectum, I applied the radium in the same way as in BERVEN'S

tonsillar irradiation, by means of a DOYEN's tweezers. On one branch of this instrument, which was introduced into the rectum against the tumour, the radium tubes with filters and lead protector for the posterior rectal wall were fixed in a pear-shaped applicator of plastic substance;

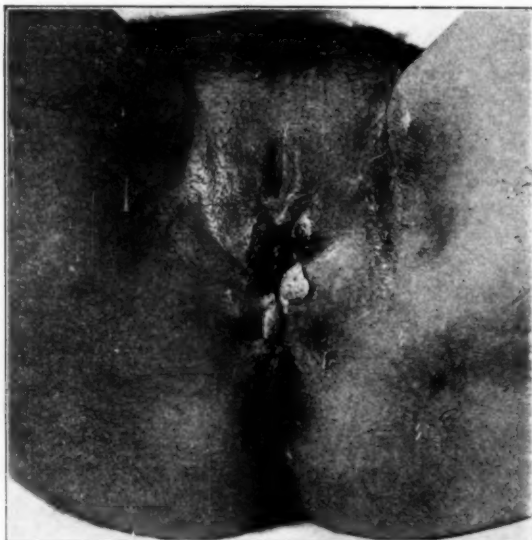


Fig. 48. Relapse of vulvar cancer to be treated with radium.

the other branch rested against the mons pubis, where it was kept in position by a pellet of the same material and by a firm bandage. The patient bore this apparatus without difficulty for 10 hours.

However, the branch of gynaecological radiumtherapy that has derived the greatest benefit from the plastic method of application is the treatment of the *vulvar cancers*. Here the old methods of application have proved very unsatisfactory, and the protection against irradiation which could be secured for the

sensitive surroundings was often illusory. The plastic substance, on the other hand, lends itself excellently both to the application of the radium prepartate and to the carrying out of the necessary protective arrangements, according to the particular demands in each case.

With tumours in the labia minora, as BERVEN has shown, we may accordingly construct an applicator in two halves embracing each labium, and these halves can thus be separated from each other »just as when one opens a book». The two halves are fixed in this position by means of extensions into the vagina, and the interval between them is finally filled up with plastic substance, so that the whole becomes firm and motionless. The further fixation is effected by means of bandages and the legs are kept immobile by means of an iron bar and cushions placed between the knees (figg. 46—47).

If the labia have been previously extirpated or destroyed by the tumour (fig. 48), we may simply make a funnel-shaped mould of the introitus and fix it by means of an extension into the vagina, which, if necessary,

can also be provided with embedded radium tubes (fig. 49). Otherwise this extension may be made tube-shaped, the radium may be placed on the inner sides of it, and the centre finally filled up with plastic substance.

With tumours of the clitoris it is most convenient to proceed in the same way, provided that no virginal hymen obstructs the fixing in the vagina. In such case, as with tumours of the penis, the apparatus may be fixed by means of a large plate, laid over the mons pubis and the groins. This plate, however, should not be applied before the last moment, and the applicator proper should be made small (so that it does not overlap the tumour area) and the radium most conveniently applied *in situ*.

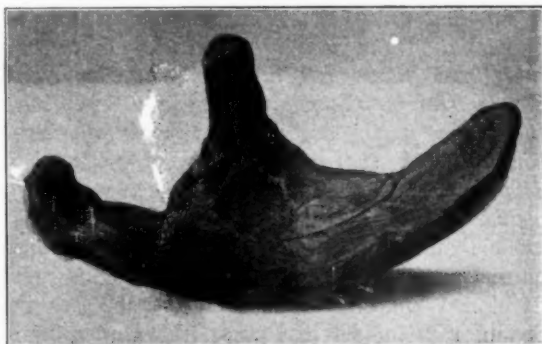


Fig. 49. Applicator for vulvar cancer, with offshoot for vagina.

Finally, in cases where the cancer has completely destroyed the labia and introitus, so that a great hollow or crater is formed, I would strongly recommend applying the radium by covering the walls of the hollow with a layer of plastic compound and afterwards placing the tubes by the same means in the centre, whereupon the rest of the crater should be filled out by the mass. A bandage will fix the applicator on its place during the treatment.

The figures 27—31, 33—34, 36—37 and 39, 46—47 are borrowed from the work of BERVEN on the same topic, and I am very much obliged to him for his kindness in letting me make use of his clichés.

Summary

This work gives a report on a method of application in radium therapy, originally found by the author in 1915 and developed by him, in the following years, to a high degree of universality, namely, the use of plastic dental compounds.

In the introduction, the author enters upon the demands that should be made on a method of application meant for a universal employment

and from this point of view makes a valuation of the methods hitherto in use, the conclusion of which is that no one of these approximatively can be regarded as generally practicable.

The first part of the work describes the origin and development of the author's method. His definitive technique may be thus summed up:

An impression of the tumour and its immediate neighbourhood is prepared out of the plastic compound. On the outside of this cast the radium tubes and filters are attached according to the indications furnished by the impression, the plastic compound itself serving partly as a secondary filter and partly as a means of regulating the distance of irradiation. Finally, both the protection arrangements for the healthy tissues and the actual fixing of the apparatus are secured by the aid of the plastic compound.

This method may be used not only in outward skin regions but also on the tumours of a great many mucous membranes and has been thus developed quite independently of the relatively very limited use that certain radiologists in France, the United States, England and Germany seem to have made of dental compounds for such purposes.

Further on the author dwells in considerable detail on the results of the chemical and physical researches brought about by him in order to investigate the filtering properties of the dental compounds. Among the compositions thus analysed the »Kerr Perfection Impression Compound» proved by far the most suitable. All the compounds seem to have a percentage of inorganic substance, varying between 50 and 57.6 % and virtually consisting of aluminium-magnesium oxide, probably a modification of the mineral *spinel* (MgO , Al_2O_3). This is to be regarded as an advantage, since aluminium and probably also magnesium are distinguished by giving a relatively inconsiderable secondary radiation.

The filtering measurements of the plastic mass have been carried out under comparison with the secondary filter mediums hereto generally used, viz. India rubber, paper and surgical gauze and have given the following results, illustrated by curves.

a) The impression compounds as well as the secondary filters just named absorb the primary radiation of radium in a very slight degree (12—20 % of the total radiation), the thicknesses of material mostly used in therapeutics provided.

b) As to the emergence radiation of the secondary filtering mediums as such, it will rapidly increase with a very thin layer of material (about 1 mm.), but then again rapidly diminish; with »Kerr», it is considerably less than with the older secondary filters (at least in thicknesses of 2—10 mm.):

c) The measurements of combinations of lead filters with various secon-

dary filter mediums have shown that these will cause a considerable decrease of the emergence radiation of the lead already with thin thicknesses of the material (as to »Kerr« by a percentage of about 80 % with a layer 1 mm. thick, an absorption that will remain nearly constant with an increase of thickness up to 10—11 mm. which proves the advantage of that substance in radium therapy).

In the following parts of the work, the author gives an account of the general principles of the use of the plastic substance in therapeutics and further, in special chapters, detailed descriptions of the different appliances and modifications afforded by the plastic method in the treatment of tumours of various skin regions, of the lips, of the mucous membranes of the mouth, jaws, palate and tongue. Next, he enters upon the radium application in the upper air-passages, including the palatine arches and tonsils, on the penis, in the rectum, and finally in the female genitary organs. As to these different details, however, we must refer to the work itself.

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Recherches comparées sur les conditions de motilité de l'estomac après le repas d'épreuve clinique et la bouillie de baryte

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Depuis que l'examen radiographique a conquis droit de cité pour les affections du tube digestif, on a publié de nombreuses communications sur les conditions de motilité de l'estomac après l'ingestion d'un repas opaque. On a tout d'abord, naturellement, cherché à constater combien de temps il fallait à des estomacs normaux pour se vider dans ces conditions et, on a ensuite essayé d'établir une limite entre une motilité physiologique et une motilité supposée pathologique.

Certes, tous les sujets qui souffrent de l'estomac salueraient avec joie le moment où l'examen avec la sonde, qui ne jouit pas d'une grande popularité, pourrait être remplacé complètement par l'examen radioscopique. Mais, même s'il ne devait pas en être ainsi, il est, en tout cas, plausible d'admettre que les examens de la rétention après l'ingestion de la bouillie barytée, pourraient former un excellent complément des épreuves cliniques de la motilité.

Comme on le sait, la durée d'évacuation de l'estomac après administration d'un repas opaque dépend de divers facteurs. Elle dépend, en première ligne, de la *nature* du sel métallique utilisé; je m'occuperai plus loin de cette question avec plus de détails. Elle dépend, ensuite, de la *quantité* du produit employé pour ce repas et comme nos devanciers ont fait usage dans leurs recherches de quantités tout à fait différentes, on ne doit pas s'étonner si leurs résultats ont quelque peu manqué de concordance.

En outre, la durée d'évacuation dépend de la *constitution du véhicule*. Cependant, on emploie à peu près partout uniquement des hydrates de carbones (avec un peu de cacao ou un autre correctif de ce genre), de sorte que nous pouvons nous dispenser d'aborder cette question.

Cette durée d'évacuation dépend encore de la *consistance* du repas: en effet, une bouillie épaisse passera plus lentement à travers le pylore qu'un repas plus fluide, tout en étant de même nature (Stierlin; recherches personnelles). La consistance doit, de préférence, être celle d'une soupe à l'avoine épaisse, d'abord, parce que les malades peuvent la boire rapidement dans un verre, au lieu de l'absorber péniblement, bouchée par bouchée, avec une cuiller et ensuite parce que le produit employé pour la différenciation sous une forme relativement fluide peut mieux pénétrer dans les petits replis et dans les autres inégalités (Stierlin).

Enfin, il faut que le repas soit aussi homogène que possible et qu'il soit absorbé tiède; en tout cas, on indique qu'une différence importante de température peut avoir une influence sur la fonction motrice de l'estomac.

D'après les recherches des auteurs antérieurs, la durée d'évacuation des estomacs normaux est la suivante:

Après bouillie au bismuth: 2 à 4 heures (Rieder, Kästle, Groedel, Haudek, Stierlin etc.)

Après le repas à la baryte: 1 à 3 heures (Groedel, Stierlin etc.) Mais, plusieurs de ces auteurs font en même temps ressortir que, chez les femmes en particulier, il n'est pas rare de constater une durée d'évacuation supérieure de quelques heures à celle que nous indiquons ici, sans que ces sujets présentent des symptômes cliniques de quelque nature que ce soit. Et même, Haudek estime que, si un estomac n'est vide que 6 heures après absorption de la bouillie de baryte, cela ne veut pas nécessairement dire qu'il y ait rien qui contrarie sa faculté motrice; celle-ci en effet, peut être influencée par diverses circonstances accidentelles, telles que émotions psychiques, position latérale droite ou gauche, repos ou mouvement etc.

Il est cependant une question importante et que je n'ai trouvée mentionnée nulle part, c'est celle de savoir, si, *ceteris paribus*, un estomac normal a une durée d'évacuation approximativement constante ou si, chez le même sujet normal, on peut constater des variations à cet égard et, s'il en existe, quelle est leur étendue.

J'ai cherché à résoudre ce problème et en même temps à me faire une opinion personnelle sur les conditions de motilité de l'estomac normal après un repas au bismuth et un repas à la baryte; pour cela: à des sujets adultes, qui n'avaient jamais présenté de symptômes morbides du côté du tube digestif, j'ai fait absorber 4 portions de bouillie opaque à environ une semaine d'intervalle. Les repas d'épreuves utilisés dans ces cas étaient les suivants;

1)

Carbonate de Bismuth 50 gr.

Sucre en poudre

Cacao pulvérisé ana 20 gr.

Farine de riz 15 gr.

2)

Sulfate de baryte: 150 gr.

Sucre en poudre

Cacao pulvérisé ana 20 gr.

Farine de riz 15 gr.

La dernière formule est celle qu'on emploie toujours à la clinique radiologique de Rigshospitalet.

Le résultat de cette expérience ressort du tableau suivant.

	Bouillie au bismuth		Bouillie à la baryte	
	1ère exp.	2me exp.	1ère exp.	2me exp.
Durée d'évacuation entre 2 et 3 h.	11	9	12	17
Durée d'évacuation entre 3 et 4 h.	8	10	7	3
Durée d'évacuation entre 4 et 5 h.	1	0	1	0
Durée d'évacuation au delà de 5 h.	0	1		

Il était donc démontré de façon purement numérique, dans les deux expériences faites avec la bouillie de bismuth, qu'environ la moitié des sujets examinés évacuait leur estomac en moins de 3 heures et l'autre moitié à peu près entre 3 et 4 heures; de plus, un sujet, dans la première expérience employait plus de 4 heures pour cette évacuation et un, dans la deuxième expérience, employait plus de 5 heures.

Après les repas à la baryte, la plupart des estomacs étaient vides au bout de 3 heures; cependant, dans la première expérience 7 et dans la seconde 3 sujets présentaient un temps d'évacuation entre 3 et 4 heures et un sujet, après le premier repas, mettait plus de 4 heures dans le processus d'évacuation.

Si, cependant, nous étudions d'un peu plus près les conditions d'évacuation des divers sujets dans les différentes expériences, nous constatons qu'après la bouillie bismuthée, il y eut seulement quatre sujets qui évacuèrent leur estomac en moins de 3 heures dans les deux expériences et trois seulement qui l'évacuèrent toutes les deux fois entre trois et quatre heures. Après le repas baryté, il y en eut 11 qui, dans les deux expériences, présentaient une durée d'évacuation inférieure à trois heures et un seulement qui, toutes les deux fois, évacua son estomac entre trois et quatre heures après le repas. En d'autres termes, nous eûmes 7 résultats identiques dans les deux expériences avec la bouillie de bismuth et 12 après la bouillie de baryte.

Si maintenant on se demande s'il peut s'agir de grandes variations dans les durées d'évacuation chez les mêmes sujets normaux, je puis répondre que chez 7 (5 femmes et 2 hommes) de mes 20 sujets d'expérience, il y avait une différence allant de 1 heure à près de 3 heures dans la durée d'évacuation lors des deux expériences avec la bouillie de bismuth et que, chez 5 (3 femmes et 2 hommes) il y avait à cet égard une différence allant de 1 heure à 1 heure $\frac{1}{2}$ après les repas à la baryte et de plus, que 4 de ces sujets présentaient des variations importantes, également après la bouillie au bismuth et après celle à la baryte.

Il ressort donc de mes recherches ci-dessus :

Que la plupart des estomacs normaux se vident dans un laps de temps variant entre 2 et 4 heures après le repas opaque;

Que, dans la plupart des cas, la bouillie de baryte passe un peu plus rapidement l'estomac que la bouillie au bismuth, mais non avec une rapidité double comme l'indique Groedel, et encore cela n'a pas toujours lieu (dans 75 % seulement de mes cas);

Que les estomacs normaux sont loin d'avoir toujours une durée d'évacuation tant soit peu constante après les repas opaques et que les variations peuvent comporter une ou plusieurs heures.

Enfin, qu'il semble y avoir certains estomacs, normaux sous les autres rapports, qui ont d'une façon habituelle une motilité étonnamment irrégulière.

Dans l'établissement d'une limite entre un temps d'évacuation normal et une durée d'évacuation pathologiquement prolongée, il faut, naturellement, tenir compte de toutes les conditions ci-dessus énumérées; on doit, au delà du temps normal maximum, accorder à la motilité un certain délai dans lequel les variations physiologiques, les circonstances accidentelles etc. peuvent se manifester avant d'avoir le droit de dire qu'il s'agit d'un état pathologique.

Des observateurs antérieurs ont en moyenne indiqué 6 heures comme la durée convenable pour les recherches de la rétention après un repas opaque (bouillie de baryte). Il est vrai que GROEDEL parle de »diminution de la motilité » pour une période d'évacuation entre 2 et 4 heures», mais par contre, il parle »d'insuffisance motrice» du 1^{er}, du 2^{me} et du 3^{me} degré, respectivement quand l'estomac emploie 4 à 6 heures, 6 à 7, et 7 à 24 heures pour son processus d'évacuation. STIERLIN pense que l'estomac est vide 6 heures après le repas, quand il n'existe pas des troubles d'évacuation très considérables; si cependant il y a encore un reliquat de la bouillie, le volume de ce reliquat fournit une appréciation approximative du degré de l'insuffisance. RUSSEL, CARMAN et WILLES indiquent la motilité comme normale quand l'estomac est vide

6 heures après le repas et HAUDEK n'attribue une importance pour le diagnostic qu'à une rétention de 6 heures de durée (environ $\frac{1}{4}$ du repas).

Dans mes recherches personnelles, j'ai radioscopié ou radiographié tous les malades 3 et 4 heures après l'absorption du repas et ensuite, si besoin en était, 5, 6 et même 24 heures après. Au début, je n'attribuai d'importance qu'aux durées d'évacuation supérieures à 6 heures, mais, comme je constatai qu'on ne trouvait des reliquats après 6 heures que chez un nombre extrêmement faible de malades, même quand les épreuves cliniques indiquaient une évacuation nettement retardée et qu'en outre seulement un très petit nombre de malades avec motilité gastrique cliniquement normale mettaient plus de 4 heures à l'évacuation de la bouillie barytée, j'arrivai très rapidement à *considérer une rétention de 5 heures comme l'expression d'une insuffisance motrice*. Je me rends évidemment bien compte que la différence entre ce que je considère comme une motilité normale et une motilité pathologique devient ainsi très faible; mais des recherches ultérieures ont corroboré ma manière de voir à ce sujet, de sorte que je ne me suis pas trouvé fondé à la modifier.

Outre mes tentatives pour établir le moment convenable des recherches sur la rétention après le repas opaque, je me suis encore imposé une autre tâche dans ces recherches, à savoir celle de comparer les conditions de motilité de l'estomac, respectivement après le repas d'épreuve de Kemp (dans un petit nombre de cas après celui de BOURGET-FABER) et après la bouillie de baryte. Je désirais voir par là s'il existait une certaine concordance entre les durées d'évacuation dans ces conditions, ou, dans le cas contraire, si les deux méthodes d'examen ne pouvaient pas se remplacer réciproquement, de sorte que l'application concomitante de toutes deux indiquerait peut-être un progrès dans le diagnostic. Ces recherches comparées n'ont été, autant que je sache, entreprises avant moi qu'une seule fois, à savoir, par RUSSEL, CARMAN et WILLES;¹ et, chez ces auteurs, il s'agit d'une comparaison entre la valeur diagnostique de la rétention de la baryte pendant 6 heures et de la rétention de 14 heures après un repas d'épreuve, de sorte que ces recherches n'éveilleront pas grand intérêt, tout au moins dans notre pays. On ne s'étonnera pas que dans ces conditions, on ait constaté que l'examen radiologique ait été de beaucoup supérieur à l'autre méthode.

Comme objet de mes recherches, j'ai choisi de préférence des malades présentant cliniquement une motilité gastrique plus ou moins diminuée; mais en règle générale, j'ai éliminé à dessein ceux qui avaient des rétentions cliniques excessives, car leurs conditions d'évacuation après le repas à la bouillie ne me paraissaient pas devoir présenter un intérêt

¹ Et plus tard par ALS-NIELSEN: Ugeskrift for Læger N° 24 1921.

capital à cet égard. Mes matériaux se composent, en plus des 20 sujets normaux dont il a été question plus haut, de 217 malades avec symptômes variés du côté du tube digestif. La majorité de ces malades proviennent du service B de Rigshospitalet. Je remercie ici le médecin chef de ce service, M. le Professeur KNUD FABER, très cordialement, de l'amabilité avec laquelle il a mis à ma disposition les malades et les registres d'observation et de l'intérêt qu'il a manifesté pour mes recherches.

Je commencerai par étudier les conditions de motilité chez 53 malades qui avaient pour diagnostic clinique:

Ulcère du corps de l'estomac.

Chez ceux-ci, par l'examen radiologique, on constata des altérations pathologiques certaines dans 18 cas, à savoir, chez 4 une « niche » sans autre déformation de l'ombre de l'estomac, chez 10 une « niche » avec une encoche constante depuis la grande courbure et chez 4 une déformation constante de l'estomac sans qu'on pût voir l'ulcère lui-même.

Chez 49 de ces 53 malades on avait fait l'épreuve clinique de la rétention avec le résultat suivant: 20 (41 %) présentaient une rétention de 6 heures, 6 (12 %) une rétention après 12 heures.

Par l'examen radioscopique, on constata 5 heures après le repas un reste plus ou moins considérable de bouillie chez 14 de ces 53 malades, (soit 26 %) tandis que 11 présentaient également une rétention de 6 heures (21 %) et que 4 n'avaient pas vidé leur estomac 24 heures après le repas. Pourtant ces 4 derniers malades avaient pris divers aliments depuis la 8ème jusqu'à la 24ème heure après l'absorption de la bouillie et il est possible que leurs rétentions aient été des « pseudo-rétentions ». C'est une circonstance qui, à ce qu'il me semble, n'est pas suffisamment relevée par la plupart des autres auteurs, de sorte qu'il ne ressort pas de leurs articles si, dans leurs cas de rétention de la baryte pendant 24 heures, il s'est agi de restes réels ou de pseudo-reliquats. Il ne sera presque jamais possible de laisser pendant 24 heures sans boire ni manger ces malades souvent très affaiblis et il faut donc toujours accepter ces « rétentions de 24 heures » avec une certaine réserve.¹

Si maintenant l'on examine d'un peu plus près les conditions d'évacuation de ces malades, on constate que, sur les 3 malades ayant de la rétention de la baryte au bout de 5 heures, un seul avait une rétention de 6 heures après le repas d'épreuve de KEMP et que sur 7 malades avec rétention radioscopique d'une durée de 6 heures, 4 seulement avaient de la rétention après le repas de KEMP; enfin les quatre malades ayant

¹ Cela s'applique aussi à mes cas de rétention de baryte pendant 24 heures, cas qui sont mentionnés dans les pages suivantes.

des reliquats barytés au bout de 24 heures avaient une rétention clinique de 12 heures (pour le repas d'épreuve).

Il existait donc une divergence assez prononcée dans les conditions d'évacuation après les deux repas d'épreuve; tout d'abord au point de vue purement numérique, cette divergence était en faveur de l'épreuve clinique, car 41 % des malades avaient une forte rétention clinique après 6 heures, tandis que 26 seulement présentaient une diminution de la motilité 5 heures après un repas à la baryte, mais ensuite cette divergence était une divergence de principe, en ce sens que seulement dans une minorité des cas *les mêmes* malades présentaient de l'hypomotilité aux deux épreuves.

En tenant compte des cas dans lesquels la présence d'un ulcère du corps de l'estomac était confirmée par la constatation radiographique d'une niche (c. à d. comme nous l'avons indiqué plus haut chez 14 de nos 53 malades) on voit qu'il existe cliniquement un reliquat considérable après 6 heures dans 75 % des cas, chez 57 % de la rétention de la baryte après 5 heures, et chez 50 % rétention de la baryte après 6 heures; on constate en outre que presque tous les malades avec rétention radioscopique présentent aussi de la rétention clinique, de sorte que la divergence ne consiste ici que dans le nombre plus grand de rétentions cliniques. Ce résultat: rétention radiologique dans environ 50 % des cas d'ulcère du corps de l'estomac concorde parfaitement avec les données de HAUDEK et de STIERLIN, quoiqu'il faille faire ressortir que ces auteurs ne tiennent compte que »d'un reste net de bouillie« (c. à d. environ $\frac{1}{4}$ du repas), tandis que j'ai fait entrer en ligne de compte des rétentions même très faibles. Il est donc possible que HAUDEK et STIERLIN dans leurs statistiques n'aient pris en considération que les ulcères qui peuvent être démontrés par l'examen radiologique et que par exemple, FAULHABER qui dit avoir trouvé des reliquats de baryte au bout de 6 heures dans 20 à 26 % de ses cas d'ulcère gastrique situé loin du pylore, ait fait ce que j'ai fait moi-même dans mon pourcentage ci-dessus et qu'il ait noté tous les ulcères du corps de l'estomac diagnostiqués cliniquement. Une autre explication de la grande différence mentionnée plus haut entre le chiffre de HAUDEK—STIERLIN et mes propres cas de rétention radiologique dans l'ulcère du corps de l'estomac pourrait être la suivante: comme nous l'avons déjà indiqué, ce sont les rétentions relativement faibles qui prédominent dans mes cas, tandis qu'il est possible que les autres auteurs aient tenu compte à un égal degré de tous les stades de la diminution de motilité.

On sait qu'il n'est pas rare de voir dans l'ulcère du corps de l'estomac qu'une hypomotilité cliniquement constatée s'améliore ou disparaisse complètement après un traitement rationnel de courte durée. Ce fut pré-

cisément le cas chez un certain nombre de mes malades et pour cette raison, j'ai recherché si les mêmes conditions existaient en ce qui concerne la rétention de la baryte. En faisant un examen (après un délai de 2 à 6 semaines) chez 6 de mes malades avec ulcère, qui la première fois avaient eu une rétention de la baryte de 6 heures, je constatai que deux de ces malades évacuaient maintenant leur estomac avec une rapidité normale, tandis que chez les 4 autres les conditions d'évacuation n'étaient pas modifiées.

Les conditions du chimisme chez les malades cités ci-dessus avec rétention de la baryte, ressortent du tableau ci-joint; comme on le verra, c'est seulement dans la moitié des cas que nous avons trouvé de l'hyperacidité ou de l'hypersécrétion. Deux des malades avaient à la fois augmentation d'acidité et hypersécrétion.

Etat du chimisme chez les malades avec rétention de la baryte

	Malades avec durée d'évacuation allant de 3 h. après la prise de baryte.	Ces malades se répartissent ainsi:		Malades avec durée 6 heures après la prise de baryte	Ces malades se répartissent ainsi:		Malades avec durée d'évacuation 24 h. après la prise de baryte	Ces malades se répartissent ainsi:	
		Hyperacidité	Hypersécrétion		Hyperacidité	Hypersécrétion		Hyperacidité	Hypersécrétion
Ulcère du corps de l'estomac	3	1	1	7	2	3	4	0	2
Ulcère juxta-pylorique	2	1	0	8	1	2	4	1	1
Ulcère du duodénum	1	0	0	2	0	1	0	0	0
Gastropiose	3	0	1	3	0	0	1	0	0
Hypotonie gastrique	2	0	0	0	0	0	2	0	1
Autres symptômes (v. tableau récapitulatif).	2	0	0	2	0	1	0	0	0

Tableau récapitulatif

	Durée d'évacuation	Ulcère du corps de l'estomac	Ulcère juxta-pylorique	Ulcère du duodénum	Gastropiose	Hypotonie gastrique	Autres symptômes
Examen radiologique	5-6 H.	26 %	64 %	13 %	18 %	50 %	6 %
	> 6 H.	21 %	55 %	9 %	11 %	25 %	3 %
	> 24 H.	8 %	18 %	—	3 %	25 %	—
Examen clinique	> 6 H.	41 %	68 %	31 %	21 %	75 %	28 %
	> 12 H.	12 %	47 %	4 %	3 %	25 %	0,7 %

¹ Dyspepsie, cardialgie, achylie gastrique, constipation chronique, Entérite et Entéro-colite chroniques.

Il me sera peut-être permis de faire en passant une remarque, c'est que j'ai été frappé de l'âge de mes malades atteints d'ulcère. Deux seulement des 53 malades en question avec ulcère du corps de l'estomac étaient au-dessous de 20 ans, la moitié était au-dessus de 40 ans, au delà du quart avaient plus de 50 ans et 12 % avaient dépassé la 60^{me} année. Je trouvai des proportions analogues chez mes malades avec ulcère stomacal juxta-pylorique, savoir: 50 % au-dessus de 40 ans; 20 % au-dessus de 50 ans et 10 % au-dessus de 60 ans et enfin chez mes malades avec ulcère du duodénum, 35 avaient plus de 40 ans, 15 % plus de 50 ans et 10 % plus de 60, tandis que 10 % seulement avaient moins de 20 ans. Comme il s'agit de 100 sujets environ atteints d'ulcère, ces chiffres ne peuvent être l'effet du hasard et d'autres auteurs également (par exemple Haudek et Stierlin) attirent l'attention sur l'âge avancé de beaucoup de leurs malades.

Le groupe que je vais ensuite étudier comprend des malades avec:

Ulcère juxta-pylorique de l'estomac
diagnostiqué cliniquement.

J'ai examiné 22 de ces malades chez lesquels, dans 7 cas, j'ai constaté un péristaltisme de sténose typique (il faut noter que cette constatation fut faite avant toute manoeuvre sur l'estomac) dans 3 cas, j'ai trouvé de l'ectasie gastrique avec péristaltisme de sténose; dans 7 autres cas, de l'ectasie avec péristaltisme normal ou ralenti et enfin, dans un cas, une petite encoche constante depuis la grande courbure à quelques centimètres du pylore. Chez 18 de ces 22 malades, par l'examen radiographique nous avons constaté aussi des symptômes d'ulcère juxta-pylorique. (Je ne m'occuperai pas d'avantage ici de la valeur à accorder au péristaltisme de sténose pour le diagnostic.)

En ce qui concerne les conditions de la motilité chez ces malades, on constata, par l'épreuve clinique, une rétention considérable, au delà de 6 heures dans 68 % des cas et dans 47 % une rétention au delà de 12 heures.

Après le repas à la baryte, il y eut un reliquat après 5 heures dans 64 %, de la rétention après 6 heures dans 55 % et enfin, de la rétention de 24 heures dans 18 % des cas.

En considérant les pourcentages seuls, on trouve donc ici par opposition avec les ulcères du corps de l'estomac, une certaine analogie entre les conditions de la motilité démontrées par la clinique et celles démontrées par la radiologie. Si, cependant, on observe d'un peu plus près la durée d'évacuation des divers malades après les deux repas, on trouve aussi dans ce groupe une divergence qui n'est pas minime.:

Deux malades avaient un reliquat baryté après 5 heures; l'un deux n'avait pas de rétention clinique et l'autre avait un reliquat au bout de 6 heures.

Huit malades avaient un reliquat baryté après 6 heures; chez deux d'entre eux l'épreuve clinique n'avait pas été faite; parmi les autres, 1 n'avait pas de rétention clinique, 1 avait une rétention considérable de 6 heures et 4 une rétention de 12 heures.

Quatre avaient un reliquat baryté de 24 heures; parmi eux 1 seul avait de la rétention clinique après 6 heures et les autres avaient un reliquat après 12 heures.

L'état du chimisme stomacal chez ces malades ressort du tableau présenté plus haut.

Si maintenant on veut, ici aussi, comme pour les ulcères du corps de l'estomac, faire entrer en ligne de compte les cas dans lesquels l'examen radiologique présentait à coup sûr quelque chose d'anormal (gastrectasie), les conditions s'établissent de manière que, également chez ces derniers, on trouva une concordance purement numérique (à savoir rétention dans environ 70 %), mais que chez deux malades avec durée normale d'évacuation après bouillie de baryte, on trouva une rétention clinique considérable de 6 heures et, chez un malade sans rétention clinique, on constata un reliquat baryté important après 6 heures.

Après repas à la baryte dans l'ulcère juxta-pylorique, les conditions d'évacuation indiquées par HAUDEK et autres auteurs, concordent à peu près avec mes résultats déjà mentionnés, car ils ont trouvé de la rétention de 6 heures dans 80 % des cas et moi dans 70 %. Cependant, je ne puis être d'accord avec HAUDEK qui affirme que l'ulcère pylorique produit toujours une augmentation du délai d'évacuation de l'estomac; chez un de mes malades dont l'estomac était vide moins de 4 heures après l'absorption du repas à la baryte et qui, du reste, ne présentait pas non plus d'hypomotilité au repas clinique, on trouva à l'opération un pylore cicatriciellement altéré et nettement rétréci. De même, les variations frappantes dans la durée d'évacuation d'un jour à l'autre, que HAUDEK mentionne comme caractéristiques des ulcères prépyloriques, ne se sont pas non plus manifestées dans mes recherches. On serait aussi étonné, me semble-t-il, de constater de pareilles variations justement dans les cas où, comme conséquence de l'ulcère, il existe des altérations organiques dans la paroi gastrique tout près du pylore.

On a prétendu que chez les malades porteurs d'un

Ulcère dans le vestibule du duodénum.

on trouve souvent une *rétention dite paradoxale*, c. à d. une évacuation initiale étonnamment rapide, mais, néanmoins, un reliquat considérable après 4 heures. Comme l'a mentionné PANNER, l'année dernière à la Société danoise de médecine interne, on a donné plusieurs explications différentes de ce type remarquable de motilité. KREUZFUCHS pense, par

exemple, que l'ulcère du vestibule produit une hypersécrétion du duodénum et du pancréas, grâce à laquelle, au début du processus d'évacuation, le suc gastrique est rapidement neutralisé et le réflexe pylorique diminué; ensuite, la sécrétion gastrique fortement acide prend le dessus et comme conséquence, il se produit un état spasmodique du pylore, de sorte que la dernière partie de l'évacuation se fait lentement. ÅKERLUND donne une autre explication de la rétention paradoxale, à savoir que le vestibule du duodénum est dans un état spasmodique, par suite de l'ulcère, mais de telle manière que le spasme de la musculature longitudinale est au début le plus fort, au point de provoquer une insuffisance pylorique, tandis que le spasme circulaire l'emporte ensuite et par là retarde l'évacuation de l'estomac.

Mais ces explications sont théoriques, quoiqu'on puisse admirer celle d'ÅKERLUND, en particulier, à cause de son ingéniosité et il me semble que les conditions doivent pouvoir s'expliquer d'une autre façon, par exemple, tout simplement, par une hypermotilité initiale comme réaction naturelle de l'estomac à l'égard d'un vestibule spasmodiquement rétréci, ou peut-être un spasme pylorique et ensuite une fatigue relativement rapide du péristaltisme.

La « motilité gastrique duodénale » ne se rencontre cependant pas aussi souvent qu'on l'indique ici et on lui a certainement, attribué une valeur diagnostique quelque peu plus considérable que celle qu'elle mérite légitimement. C'est ainsi que ÅKERLUND dit avoir trouvé de la rétention paradoxale dans environ 20 % de ses cas d'ulcère duodénal, mais chez les 25 sujets atteints de cette affection et dont j'ai examiné les conditions d'évacuation, je n'ai observé qu'une seule fois un tel type de motilité. Il faut remarquer à ce sujet que la rétention paradoxale, comme déjà l'avait fait ressortir KREUZFUCHS, peut se rencontrer dans une série d'autres maladies (de la vésicule biliaire, du pancréas et de divers organes), de sorte que sa valeur diagnostique, dans les cas d'ulcère duodénal, est considérablement restreinte. Je puis, du reste, compléter la communication de KREUZFUCHS, en affirmant que la rétention paradoxale peut aussi se rencontrer dans l'ulcère *gastrique* juxta-pylorique, par exemple chez un malade chez lequel on trouva à l'opération un vestibule duodénal normal, mais, en revanche, un ulcère dans l'estomac à 3 centimètres du pylore.

Somme toute, *je ne crois pas qu'on puisse attribuer à ce type de motilité une importance notable quelconque au point de vue du diagnostic.*

J'ai mentionné plus haut que j'avais examiné les conditions d'évacuation chez 25 malades, porteurs d'un ulcère duodénal. Dans tous ces cas, nous avons constaté par l'examen radiologique quelque chose d'anormal dans le duodénum, à savoir, dans 4 cas, une ou plusieurs niches

ainsi qu'une déformation accessoire de l'ombre du renflement duodéal, dans 11 cas, une ou plusieurs encoches constantes depuis la base, ou, en règle générale depuis le côté de la grande courbure, dans 7 cas un renflement vestibulaire duodéal très déformé, lobulé, ou en forme de « bloc de corail » et dans un cas, un renflement dudodéal extrêmement considérable (malgré l'hyperacidité stomacale) qui persista sans modification pendant toute l'évacuation de l'estomac, et enfin, dans 1 cas, un rétrécissement dans la portion horizontale du duodénum. J'ajouterai que presque tous ces malades ont été examinés au moins deux fois et que certains d'entre eux ont été suivis pendant quelques années.

En ce qui concerne les conditions d'évacuation chez mes malades porteurs d'ulcère duodéal, il y avait :

Après repas d'épreuve clinique, une rétention considérable de 6 heures chez 31 % et, de plus, dans un cas, un reliquat après 12 heures.

Après bouillie à la baryte, il y avait rétention de 5 heures chez 3 malades (13 %) et rétention après 6 heures chez deux de ces trois malades.

Si nous examinons plus en détail les malades avec rétention radiologique, nous constatons qu'un d'entre eux n'avait pas de rétention clinique; un autre avait un reste considérable après 6 heures et un avait de la rétention après 12 heures.

A titre de comparaison, je mentionnerai que HAUDEK, par exemple, a observé de la rétention de la baryte de 6 heures chez environ 20 % de ses malades; mais il affirme catégoriquement que dans la moitié environ de ces cas, il s'agissait de « pseudo-reliquats gastriques » (c. a. d. comme conséquence de l'hypersecretion, ou d'absorption de liquide dans l'intervalle séparant l'administration du repas d'épreuve et la recherche de la rétention etc.). Le même auteur fait, au surplus, ressortir que beaucoup de malades avec ulcère duodéal évacuent leur estomac avec une grande rapidité; j'ai constaté le même fait dans mes recherches et le motif probable en est que dans le cas d'ulcère duodéal il existe souvent une hypertonie de l'estomac. —

Quant aux conditions d'évacuation dans *le cancer de l'estomac*, je n'ai pas de matériaux cliniques importants sur lesquels je puisse m'appuyer; mais mes résultats à ce point de vue concordent tout à fait avec ceux d'autres auteurs en particulier STIERLIN et HAUDEK. Dans le cancer du corps de l'estomac, on constate pour ainsi dire toujours que la poche gastrique se vide avec une grande rapidité, dans un délai plus court que les estomacs normaux; cela est dû probablement au fait que le réflexe d'occlusion de MEHRING est diminué ou aboli par suite de l'achylie. Dans le cancer du pylore, il existe souvent aussi une durée d'évacuation très courte après le repas à la bouillie barytique, même quand la portion

pylorique est fortement rétrécie. La première raison en est que la bouillie de baryte homogène et plastique peut très facilement (plus facilement en tout cas que le repas clinique d'épreuve) franchir une lumière rétrécie. La seconde raison est que, comme conséquence de l'infiltration cancéreuse, il se produit une insuffisance pylorique organique en plus de l'insuffisance fonctionnelle, à cause de l'absence d'acide chlorhydrique libre et cette insuffisance compense (ou même fait plus que compenser) la sténose organique. De même, dans les formes cancéreuses infiltrantes et diffuses, l'évacuation se fait habituellement avec rapidité, pour les motifs que nous venons d'énumérer. Naturellement, par la suite, il se produit un retard dans l'évacuation augmentant jusqu'à des rétentions très importantes quand la sténose devient excessive; mais les distensions et les rétentions très considérables s'observent beaucoup plus rarement dans le cancer que dans les sténoses cicatricielles, car le malade succombe souvent avant que le processus local en arrive là. Suivant HAUDEK, les rétentions radiologiques les plus fortes se rencontrent dans les cancers médullaires du pylore lui-même; il s'agit souvent ici de petites tumeurs difficile à déceler par l'examen radioscopique. Mais si l'on est en présence d'un malade ayant de l'achylie et dont l'estomac se vide plus lentement qu'à l'état normal, sans qu'on puisse trouver d'ailleurs un motif à cela, on fera bien de soupçonner une petite tumeur pylorique.

Je vais maintenant étudier les conditions d'évacuation chez les malades atteints de

Ptose gastrique

Sous cette rubrique, je comprends ceux dont l'incisure angulaire, en position debout, se trouve au moins à 2 centimètres au dessous de la ligne qui réunit les deux crêtes iliaques.

On a affirmé de divers côtés que dans la ptose gastrique il existe presque toujours une hypomotilité plus ou moins accentuée et comme cause on a indiqué une diminution de la fonction péristolique et surtout le fait que cette situation basse de la poche stomacale en forme d'estomac en hameçon et la hauteur du soulèvement de l'organe («Hubhöhe» des auteurs allemands) produiraient une plus lente évacuation. Cette dernière allégation est corroborée du reste par le fait qu'on a constaté expérimentalement qu'un estomac avec une hauteur considérable de soulèvement se vide plus rapidement en position latérale droite qu'en position latérale gauche.

J'ai essayé maintenant de rechercher si des estomacs en état de ptose ont *dans l'ensemble* une durée d'évacuation plus longue que les autres et, s'il en est ainsi, *quelle raison* on peut invoquer pour cela. Le résultat ressort du tableau suivant:

Situation de l'incisure angulaire	Nombre de cas	Rétention après bouillie de baryte	Rétention clinique considérable de 6 heures	Hypotonie
2 Cm. au dessous de la crête	4	0	1	1 cas.
3 " " " " " "	10	1 ap. 5 h. 2 ap. 6 h.	0 (3 malades non examinés)	4 "
4 " " " " " "	6	1 ap. 5 h. 1 ap. 24 h.	0	3 "
5 " " " " " "	9	1 ap. 6 h.	2 (3 malades non examinés)	3 "
6 " " " " " "	4	1 ap. 5 h.	2	3 "
7 " " " " " "	3	0	2	2 "
8 " " " " " "	2	0	1 (rétention de 12 h.)	2 "

Sur les 3 malades du tableau avec reliquat de baryte de 5 heures, un seul avait de la rétention clinique. Chez deux des malades ayant 6 heures de rétention de la baryte, l'épreuve clinique ne fut pas faite; le troisième ne présentait pas de rétention clinique. Enfin chez le malade avec une rétention radiologique de 24 heures, on ne trouva pas de rétention 6 heures après le repas d'épreuve de KEMP. En revanche, il y avait 4 malades avec rétention clinique qui présentaient des durées normales d'évacuation après le repas à la baryte.

Comme on le voit, la divergence entre les conditions de motilité des malades après les deux genres de repas était aussi marquée ici que chez les malades porteurs d'ulcère.

Il ressort donc comme conséquence du tableau:

1°) La rétention de la baryte *après 5 heures ne se rencontrait que chez 18 % des malades examinés.*

2°) La situation plus ou moins basse de l'estomac n'exerçait aucune influence correspondante sur la durée d'évacuation et en tout cas pas après la bouillie de baryte. Mes 5 malades avec les estomacs les plus ptosés avaient (probablement par le fait du hasard) une motilité normale après le repas à la baryte, tandis qu'un quart des malades avec incisure angulaire à 3 et 4 centim. au-dessous de la crête, avaient une rétention radiologique d'importance variable.

3°) Chez environ 47 % il existait une diminution de la fonction péristolique (hypotonie, atonie), ce qui veut dire que la bouillie demeure dans la partie déclive de l'estomac, tandis qu'une partie plus ou moins grande de son segment cardiaque est vide.

4°) La diminution de la tonicité n'exerçait ni une influence marquée ni moins constante sur la durée d'évacuation. Il est vrai que 6 de mes 7 malades avec rétention radiologique avaient des estomacs en hypotonie et que sur les 8 malades avec rétention clinique, cinq se comportaient de la même façon; mais, d'autre part, 12 malades avec diminution de la fonction péristolique présentaient une durée normale d'évacuation après la bouillie de baryte et 13 de ces malades ne présentaient pas de rétention clinique.

De même, le *degré de diminution de la tonicité* ne présentait pas une modification adéquate des conditions d'évacuation de l'estomac; par exemple, un estomac tout à fait flasque en apparence et dont l'incisure angulaire était située à 8 centim. au dessous de la crête et dont l'acidité était normale, se vidait en moins de 4 heures, tandis qu'un estomac en très légère hypotonie avec incisure angulaire seulement à 3 centim. au dessous de la crête et également avec un chimisme normal, présentait un important reliquat de baryte après 6 heures.

En somme, on peut dire que, *ni la position basse de l'estomac, ni une diminution de la fonction péristolique, ni les deux facteurs réunis n'exercent une influence décisive sur la motilité.*

Enfin, quant au chimisme, on verra dans le tableau qu'un seul des malades mentionnés plus haut avec rétention de la baryte avait de l'hypersécrétion, tandis que dans aucun cas on ne trouva d'hyperacidité.

Chez un certain nombre des malades dont j'ai parlé jusqu'ici, il y avait, comme nous l'avons dit, une diminution plus ou moins considérable de la fonction péristolique de l'estomac, diminution associée à une autre affection gastrique.

Dans d'autres cas, on n'a trouvé *comme unique maladie qu'une hypotonie ou une atonie* et bien qu'il ne s'agisse que d'un petit nombre de malades (8 en tout) je veux cependant leur consacrer quelques remarques, car, à tout prendre, quelques uns de ces cas me paraissent avoir un intérêt de principe.

Sur les 8 malades en question, deux avaient une durée d'évacuation normale à l'examen clinique et à l'examen radiologique; il s'agissait de sujets avec une légère hypotonie et un péristaltisme puissant.

Deux autres avaient une rétention clinique considérable de 6 heures, mais pas de rétention de la baryte; de même ici, il n'y avait qu'une légère diminution de la tonicité gastrique et un péristaltisme normal.

En outre, dans ce groupe se trouvaient deux malades qui avaient à la fois une rétention clinique de 6 heures et un reliquat barytique de 5 heures. Mais, lors d'examens répétés au bout de quelques semaines, on constata que leurs estomacs étaient vides respectivement 6 et 5 heures après les deux repas d'épreuve.

Il reste ainsi sur 8 malades, deux ayant une rétention de 12 heures après le repas d'épreuve de KEMP et une rétention de la baryte respectivement de 24 et 48 heures. Dans ces deux cas, l'estomac était fortement dilaté — de même que la portion pylorique — et flasque; l'incisure angulaire se trouvait au niveau de la ligne qui réunit les deux crêtes iliaques, la partie inférieure de la grande courbure était un peu au dessus de la symphyse. A l'opération, contre mon attente, on trouva un pylore facilement franchissable et pas la moindre trace d'ulcère de l'estomac ni près

du pylore ni ailleurs. Il s'est donc agi de deux cas d'atonie considérable et ces cas démontrent qu'il peut exister une rétention de 24 heures dans l'estomac après le repas à la baryte, sans qu'il y ait d'altérations cicatricielles au niveau du pylore ou sans autres modifications constatables à part la dilatation. J'insiste sur ces cas, car on a prétendu qu'une semblable rétention de 24 heures prouvait une sténose pylorique organique (HAUDEK) et que déjà un reliquat de bouillie après 12 heures parlait en faveur de cette rétention (KÄSTLE).

Je rappellerai, du reste, à ce propos que, parmi mes malades porteurs d'ulcère mentionnés plus haut, il s'en trouvait un qui avait une forte rétention de la baryte 3 jours après le repas et que chez lui à l'opération, on constata un ulcère de la petite courbure à 6 centim. du pylore, tandis que ce dernier était facilement perméable pour un doigt. Une rétention radiologique de 24 heures ne prouve donc nullement une sténose organique du pylore, mais elle peut exister à la fois dans l'ulcère du corps de l'estomac et dans les dilatations de l'estomac par atonie.

Je résumerai brièvement les faits concernant les autres malades dont j'ai examiné la motilité gastrique.

Il s'agit tout d'abord de 20 malades, dont les diagnostics cliniques étaient: *dyspepsie*, *cardialgie* et *achylie gastrique*. Cinq d'entre eux (25 %) avaient une rétention clinique considérable après 6 heures (aucun après 12 heures) tandis qu'un seul (dyspepsie, neurasthénie) avait un reliquat de baryte après 5 heures et un autre (achylie gastrique, diarrhée) avait une rétention radiologique de 6 heures; ces deux malades avaient également de la rétention clinique.

Il y avait, en outre, 34 malades avec *constipation chronique* dont 9 (25 %) avaient de la rétention clinique de 6 heures, 1 avait de plus un reliquat de baryte de 12 heures. A l'examen radioscopique, deux sujets qui n'avaient pas présenté d'hypomotilité clinique avaient un petit reliquat barytique après 5 et 6 heures respectivement; ces deux malades furent examinés de nouveau au bout de quelques semaines et ils eurent alors une durée normale d'évacuation.

Enfin, j'ai eu 18 malades avec *entérite* et *entéro-colite chroniques*. Six d'entre eux avaient une rétention clinique de 6 heures (33 %) tandis que tous les estomacs étaient vides au plus tard 4 heures $\frac{1}{2}$ après un repas à la baryte.

Comme on le sait sans doute, HAUDEK a indiqué une «*méthode double*» pour l'examen radioscopique de l'estomac et de sa motilité en une seule séance. Je ne m'occuperai pas de la technique ou des détails de cette méthode, mais je dirai seulement que si je l'ai vite abandonnée, bien qu'elle soit préconisée par divers auteurs, c'est qu'à mon avis elle ne

présente pas d'avantages pratiques spéciaux sur la méthode généralement usitée. De plus, il serait certainement malaisé d'amener les malades à absorber deux repas à la baryte en une même journée, outre une quantité adéquate d'eau barytée et enfin dans un nombre assez élevé de cas, on est obligé, comme le fait ressortir Haudek lui-même, de se livrer à un nouvel examen de la motilité 1, 2 et jusqu'à 3 heures après le dernier repas à la baryte absorbé. Si l'on devait employer la méthode double, je conseillerais, en tout cas, d'examiner le malade 5 heures après l'ingestion du premier repas à la baryte (et non pas 6 heures comme le veut HAUDEK).

En comparant les conditions de motilité de l'estomac après le repas d'épreuve de Kemp et le repas à la baryte chez 217 malades atteints d'affections du tube digestif, je suis donc arrivé aux résultats suivants:

La méthode clinique est celle qui donne les renseignements les plus précis car dans presque toutes les formes pathologiques on trouve un nombre de rétentions cliniques beaucoup plus considérable qu'avec la bouillie de baryte, même quand l'examen radioscopique est pratiqué, déjà 5 heures après le repas;

De plus, la divergence entre les résultats n'est pas seulement purement numérique, mais elle se manifeste aussi en ce que souvent ce ne sont pas les mêmes malades qui présentent une augmentation de la durée d'évacuation après les deux genres de repas.

Je ne puis malheureusement pas dire sur quoi reposent ces différences, car je n'ai pu élucider cette situation par mes recherches. Comme les facteurs qui peuvent jouer un rôle dans le processus d'évacuation (forces expulsives de l'estomac et chimisme de cet organe, ainsi que résistance plus ou moins grande au passage) sont absolument identiques dans les deux méthodes d'examen, alors que seule la nature du repas d'épreuve diffère dans les deux cas, il doit venir à l'esprit d'attribuer à ce dernier facteur la cause des divergences constatées dans les conditions de la motilité. Mais, comme il est facile de le voir, cette explication ne peut pas donner satisfaction; si tel était le cas, on pourrait s'attendre à trouver soit parmi les malades, soit sous des formes pathologiques déterminées, une différence dans le nombre des rétentions cliniques et radiologiques, tandis qu'on ne comprend nullement pourquoi des malades avec la même affection et les mêmes conditions d'évacuation peuvent se comporter d'une manière si extraordinairement différente après les deux repas d'épreuve, comme nous avons constaté que cela se passait.

Ainsi que nous l'avons mentionné plus haut, l'épreuve clinique de 6 heures montre dans un nombre de cas plus grand que l'examen radiologique, 5 heures après un repas à la baryte, qu'il y a un obstacle aux

conditions d'évacuation de l'estomac. Mais, en revanche, il ne paraît pas douteux qu'un reliquat de baryte après 5 heures signifie davantage quand on le constate et qu'il a donc *une plus grande valeur* dans les affections où la question des conditions de motilité est d'un intérêt tout spécial. Cependant, la méthode radioscopique n'a rien de « spécifique » dans le sens qu'elle fournirait des renseignements diagnostiques particuliers lors de certaines affections gastriques, par exemple dans l'ulcère.

A en juger par mes recherches, l'épreuve radiologique ne peut donc remplacer en rien la méthode clinique. *Mais les deux épreuves peuvent se compléter mutuellement*, car, en les employant toutes deux, on trouvera une augmentation de la durée d'évacuation plus fréquemment que lorsqu'on a recours à une seule de ces méthodes. L'examen radiologique présente pourtant au point de vue diagnostique l'avantage important suivant: outre qu'on peut constater avec une exactitude absolue le nombre d'heures et de minutes qu'un estomac met à se vider, on peut en même temps, avec la même facilité avoir un tableau fidèle du péristaltisme, de la tonicité et des obstacles éventuels au passage, c. à d., de presque tous les facteurs dont l'ensemble détermine la motilité gastrique. Et, en comparant les deux conditions: durée et conditions d'évacuation, on arrivera, dans beaucoup de cas, à un diagnostic exact ou tout au moins on aura fait un grand pas en avant vers le diagnostic exact.

En terminant, il me reste à remplir la tâche agréable de remercier mon chef de service, M. le Dr PANNER, pour l'autorisation qu'il m'a donnée de faire des recherches à la clinique radiologique et pour l'intérêt dont il a fait preuve à l'égard de mon travail.

Résumé

La plupart des estomacs normaux se vident dans un laps de temps variant entre 2 et 4 heures après le repas opaque, et dans la plupart des cas, la bouillie de baryte passe un peu plus rapidement l'estomac que la bouillie au bismuth.

Les estomacs normaux sont loin d'avoir toujours une durée d'évacuation tant soit peu constante après les repas opaques et les variations peuvent comporter une ou plusieurs heures.

Il semble y avoir certains estomacs, normaux sous les autres rapports, qui ont d'une façon habituelle une motilité étonnamment irrégulière.

Les conditions de motilité de l'estomac ont été, en outre, examinées chez 217 malades ayant diverses affections du tube digestif; les examens furent faits, soit 6 heures après le repas d'épreuve de Kemp, soit 5 heures après ingestion de bouillie de baryte (avec 150 gr. de sulfate

de baryum). Une rétention de la baryte après 5 heures doit, probablement, être considérée comme la manifestation d'une insuffisance motrice et l'auteur recommande, pour ce motif, de faire les examens radiologiques de la motilité 5 heures (*et non pas 6*) *post coenam*.

Il ressort des recherches mentionnées ci-dessus que la méthode clinique est celle qui donne les renseignements les plus exacts, car dans presque toutes les formes pathologiques, il y avait un nombre de rétentions cliniques beaucoup plus grand qu'avec la bouillie à la baryte, tandis que, en revanche, la rétention radiologique paraît avoir une signification plus considérable quand elle existe. En outre, non seulement, on a constaté une divergence numérique entre les résultats des deux épreuves, mais souvent, ce ne furent pas les mêmes malades qui présentaient une augmentation de la durée d'évacuation après les deux repas. L'épreuve radiologique ne peut donc remplacer entièrement la méthode clinique; mais les deux épreuves peuvent se compléter, car, en les employant toutes deux, on trouve une augmentation de la durée d'évacuation de l'estomac plus souvent que quand on se sert d'une seule des deux méthodes.

Les épreuves radiologiques n'ont rien de «spécifique» dans le sens où elles devraient fournir des renseignements diagnostiques particuliers dans certaines affections gastriques, par exemple dans l'ulcère.

Une rétention de la baryte de 24 heures (pseudo-rétention) peut exister sans qu'il y ait des altérations ulcéreuses ou cicatricielles au niveau du pylore, ainsi par exemple dans l'atonie et les ulcères du corps de l'estomac.

Dans la ptose gastrique, ni la situation basse de l'estomac, ni un état d'atonie de l'organe, ni ces deux facteurs réunis ne paraissent avoir une influence capitale sur la durée d'évacuation.

La rétention «paradoxale» n'a aucune importance essentielle pour le diagnostic de l'ulcère du duodenum.



Clinical Examinations of a 4 hours' Roentgen Retention*

by

Th. Eiken, M. D.

Assistant Surgeon

The contrast-meal has a great advantage over other test meals as one can follow its course throughout and thereby gain information most varied and of the greatest value. Among other advantages one is thereby able to form a good conception as to the power of the stomach of emptying under normal and pathological conditions; on this empirical base there can undoubtedly be drawn important conclusions from the observation of the time at which the stomach has emptied itself. For this is demanded a series of examinations difficult to be carried out in large hospital departments with clinical patients.

In order that a roentgen ray examination of the variations in the motility of the stomach can be accepted by the clinician it is necessary — as with the common test meals — that one should decide a definite time for examining the condition of the stomach.

As is well known, the statements as to the normal emptying time of the stomach are rather different, however, according to the opinion of most it is considered likely that the stomach usually empties itself in four hours, and that retention over that time must consequently be an indication of a pathological condition.

In our department at Bispebjerg Hospital since 1916 we have examined a series of patients with a view to getting material on the foundation of which we were able to form a judgment as to the circumstances and significance of »the four hours' roentgen retention».

All examinations are made from bed-patients who have the contrast-meal on an empty stomach and who are allowed nothing else to eat for the four following hours.

300 grammes of thin rice flour gruel (rice flour 1 gramme, milk 10 grammes) with the addition of 100 grammes barium sulphate is used as a contrast-meal.

* Read at the II meeting of the Nordisk förening för medicinsk radiologi at Copenhagen. Sept. 1921.

Two of Ewald's test meals (in the controlled cases, however, only one) and one of Bourget's 8 hours' retention meal is also in nearly all cases undertaken.

(Women patients are not examined during the menstruation period).

I have measured in each case the amount of the retention on the plates. The common statements as to the size of the roentgen retention meal compared with fruits, eggs or the like generally and especially in this connection are much too inexact, and could easily be made more exact with the help of a transparent paper divided into squares. If the shadow is a little faint, it is a great help to increase the contour on the glass side of the plate by a grease pencil and measure in this manner. I have indicated the retention in this way:

10 cm²: Inconsiderable,

11—20 » : Little,

21—40 » : Medium size,

more than 40 » : Great.

The two chief questions now remaining are:

- 1) Is a 4 hours' roentgen retention pathological?
- 2) How great a roentgen retention can be found in different pathologic conditions?

The first question is not quite easy to answer completely. There is every reason to believe that the conditions of retention are otherwise for patients who are up than for bed-cases; and to keep a great succession of completely healthy people in bed for several days for the sake of such an examination seems to me, practically speaking, to be impossible.

Then, among my large material, I selected quite mildly attacked patients, where the examination showed that their disease had absolutely no connection with the digestive canal in the widest signification. But of course, here I might proceed under criticism, and therefore I only succeeded in finding 14 suitable cases of this kind. As I necessarily, of course wanted to have greater numbers for my survey, I chose to consider in addition healthy patients with hernias and the like in this examination, which in these cases I could undertake with some show of right, so that in all I had for my purpose 50 cases in this series.

The examination showed in

32 cases no retention,

14 » inconsiderable retention,

2 » little »

1 » medium-large »

1 » great »

In the last case it was a question of a 70-year-old man who did not present signs of digestive disturbances of any kind. The stomach had a natural appearance,

high-lying and well contracted, acidity numbers good; though considering his great age it was not impossible that the patient had the beginning of an otherwise symptom-free cancer, for instance, which was the cause of the retention.

On the above-mentioned foundation one may therefore venture the opinion that with some justification the inference can be drawn *that, in regard to persons in bed, a four hours' roentgen retention must generally be considered pathological. Although one hardly dare attach decisive significance to inconsiderable or little retention*, yet it may well be considered as a warning in this particular case.

For the estimation of the extent of the roentgen retention in pathological conditions I have viewed my material very carefully. At first I have demanded a precise diagnosis, which in individual cases of mine is based on the foundation of a careful clinical examination, but in most cases the clinical diagnosis is further verified (contingently corrected) by operations, in certain cases also post-mortem. For the others I have only used cases without complication, since I have refused all cases where there were found symptoms of more than one disease, which could be thought to have an influence on the emptying time of the stomach. In this manner I might have rejected half of our cases altogether.

I shall now produce the results of the examinations in the diseased groups concerned, where my material included 240 cases.

Ulcus & cancer ventriculi & duodeni. 41 cases all operated on with the exception of four cases of duodenal ulcer. Of 29 cases of *pyloric and juxtapyloric diseases* 4 showed inconsiderable or little retention, and 25 showed medium-great or great retention. In six cases of *duodenal ulcer* no retention was found in two cases, in three cases little, in one case great; in six cases of *ulcus s. cancer corporis s. cardiae* in three cases inconsiderable, in three cases medium-great or great retention. From this it appears, as expected, that the *retention is to be found particularly in those cases where the disease especially affects the pylorus or antrum only and is less pronounced in more distant sites*; that in all cases of pyloric stenosis one gets significant information through later examinations need not be further mentioned.

Gastroptosis. 35 cases, of which 5 had been operated on. In this group I have included those cases where the lesser curvature of the stomach was lying definitely, that is to say at least 1 centimeter, under the intercrystal line. *In all cases a roentgen retention was found*, in 3 cases inconsiderable, in 6 cases little, in 17 cases medium-large, in 9 cases great. In 18 cases where the lesser curvature was lying up to 3 centimeters under the intercrystal line there was little or inconsiderable retention in 6 cases, medium-large or great in 12 cases; while in 17 cases, where the lesser curvature lay more than 3 centimeters under the

intercrystal line, there was little or inconsiderable retention in 3 cases, medium-large or great in 14 cases. As expected, *the greatest retention was found with the worst degree of ptosis*, the retention, however, was not constantly proportional to the degree of ptosis.

Cholelithiasis. 137 cases, of which 87 had been operated on. In 31 cases no retention was found, in 23 inconsiderable, in 21 little, in 35 medium-large, in 27 great. In those cases *in which the gall bladder was free from adhesions the retention was perceptibly smaller than those cases in which the gall bladder was adherent to the surroundings*; thus there was found in 33 cases of free gall bladder no retention in 14 cases (42 per cent), inconsiderable or little in 10 cases (30 per cent), medium-large or great in 9 cases (28 per cent); while in 54 cases of adherent gall bladder there was no retention found in 10 cases (19 per cent) inconsiderable or little in 15 cases (27 per cent) medium-large or great in 29 cases (54 per cent). *Still more pronounced was the difference between the cases with sterile or the cases with infected gall bladder*; thus there was in 32 cases with sterile gall bladder no retention in 12 cases; inconsiderable or little in 9 cases, medium-large or great in 11 cases, while in 17 cases with infected gall bladder there was no retention in one case, inconsiderable or little in 4 cases, medium-large or great in 12 cases. Taking them altogether, however, it clearly appears from the above statistics *that the gall stones in themselves must be a matter of great moment for the retention.*

Intestinal diseases. 27 cases of which 13 had been operated on. In 10 cases no retention was found, in 8 inconsiderable or little, in 9 cases medium-large or large. An uncomplicated disease of the intestine is consequently rather often the cause of considerable retention, but still more often, however, only little or no retention is to be found.

Summary

On comparing the different groups it may be said as a general rule *that the further away the disease is removed from the stomach, the less is the influence on its emptying capacity*, and we come nearer and nearer to the conditions which we find in the normal digestive canal.

As a *result of the examinations* the author ventures to say that, in a Four Hours' Roentgen Retention we have *a delicate test of the emptying capacity of the stomach, a test which, however, must always be judged in association with the other clinical findings.*

The examinations are steadily continuing and will later be brought forward on a broader basis and in a much more fully worked-out form.

Roentgen Examination of Ileocaecal Tuberculosis with Special Reference to the so-called Stierlin-Sign

by

P. Flemming Møller, M. D.

The clinical diagnosis of ileocaecal tuberculosis can be difficult, particularly in its primary stages, where one as yet cannot feel any tumour. The symptoms have not any characteristic character, and a confounding with chronic appendicitis, typhlitis or common colitis is very common. With this complaint, as with so many other alterations in the digestive tract, the development of roentgen diagnostics has, however, in the last ten years, yielded the clinicians invaluable help, and it is STIERLIN who has the merit of first showing the possibility of roentgen diagnosis on this point, as of ulcerative processes generally in the large intestine.

It was in 1911 that STIERLIN published his first work: »Die Radiographie in der Diagnose der Ileocaecaltuberculose», in which he contended that this complaint gave a characteristic roentgen picture which was looked upon as so typical that, since then, it has been called »STIERLIN's sign». It consists in that 5—8 hours after a contrast meal one finds the caecum and colon-ascendens not filled, as one normally at this point of time would find it, but, on the contrary, empty, while the contrast meal fills the immediately neighbouring parts of the intestine, the colon transversum and the lowest part of the ileum. That the picture is pathological is at once recognised, as the absence of a shadow of the caecum and colon-ascendens between a visible lowest part of the ileum and colon transversum is never found under normal conditions. STIERLIN reported at once that this roentgen sign was found with a heavy infiltration of the intestine wall, as well as in the cases with only superficial tubercular ulcerations, where also the intestine wall was still expansible in about normal manner; but he suggested that the described sign is not exclusively characteristic for tubercular changes but generally is an expression for chronic inflammatory, indurative-ulcerating processes in

the ileocaecal neighbourhood. It can, in addition to tuberculosis, as the most frequent cause of tumour formation in this section of the intestine, also be found with, for instance, cancer, lues or actinomycosis (one of the first cases reported was a caecum cancer). Moreover, the post mortem in STIERLIN's cases showed that the spreading of the process in the intestine exactly corresponded to the shadow defect shown on the roentgenogram.

Physiologically, the contents of the intestine remain longest in the caecum and colon ascendens, longer than in any other section of the colon; and the reason hereof must, according to examinations made by STIERLIN himself, be sought in these facts, that the caecum and ascendens are the broadest parts of the intestine, that the wall of the caecum is the weakest in the whole colon, and perhaps, also, as a consequence of the antiperistalsis in this section of the colon.

STIERLIN now seeks to associate the absent shadow of the caecum-ascendens with the ileocaecal alterations, and with a very quick passage of the contents of the intestine through the diseased part of the intestine. When the intestinal wall is stiff through heavy infiltrations, the factors, says he, which, under normal conditions facilitate the long stay of the contents in the caecum and ascendens have fallen away, and the contents therefore pass very quickly through, in the same manner as the quick passage through the stomach when totally infiltrated by scirrhus. In the cases where the wall is not infiltrated STIERLIN thinks that the quick passage is owing to an irritated condition of the intestine, in consequence of which the contents are very quickly conveyed away, and he supports this supposition by the fact that, at an operation, he found a contraction of the wall at the level of the ulcer which was present. He is also of the opinion that the striped shadows which may be found as remnants of contrast-contents in the caecum (as one supposes owing to the adhesiveness of the sulphate of barium on the ulcerated mucous membrane) may be due to the same cause (irritation and rapid passage), and he compares them with »the tattered, torn skies as we see high in the heaven after a storm in the uppermost air stratum».

STIERLIN has altogether made public 8 cases with these signs mentioned, all controlled either by operation or post mortem; 7 of the cases were tubercular, the 8th a cancer; and he has shown that this sign is regularly to be found with the conditions mentioned in the ileocaecal region, also in quite early cases which cannot be substantiated for certain by clinical examinations. He attributes to the roentgen finding so great a diagnostic signification that, with a palpable tumour or resistance in the ileocaecal-region, but a negative roentgen finding, he holds one can exclude the complaint treated of, and infer the presence of a chronic appendicitis.

Conditions of the kind treated of in the ileocaecal region are not rare, and if the now-described roentgen finding (whose recognition is so obvious that, with the first glance on the screen, one can see it) were really regularly found with these complaints, also at an early period, in a case where the clinical diagnosis is yet uncertain, then it would be expected that, in the literature, one would find countless confirmations of this.

This is, however, far from being the case. Since STIERLIN's announcements in 1911, there is only one case reported by KIENBOECK in 1913, two by FAULHABER in 1914, two cases by SCHWARZ, and in 1918 two cases by REVÉSZ—consequently seven cases in all. Already this seems (when one takes the frequency of the complaint treated of into consideration) to make one somewhat sceptical with regard to the value of STIERLIN's roentgen finding. And when one thinks more closely over the picture described, it must certainly also occur to one that there is something paradoxical in it. It does not at all correspond to the picture we in general have of tumour formation in the digestive canal — for there is distinctly no question of any stricture in the caecum or colon ascendens, nor, based on this, the appearance of a defect in the shadow of the intestine as one finds it in other places in the intestine, for instance, with cancer; the passage in the colon ascendens is by post-mortem confirmed to be quite free, only in the ileocaecal region there has, in some cases, been a narrowing. And STIERLIN's explanation of the quick passage of the contents of the intestine through the diseased section is not immediately obvious, in any case not in the cases where the wall is stiff through heavy infiltrations. The comparison with scirrhus ventriculi does not here hold good, for one sees there the rest of the space in the stomach filled, although the contents quickly flow out into the intestine. It would be quite natural that a filling of the caecum, when the walls are stiff through infiltration, should be far from lasting so long as under normal circumstances (16–20 hours), but it is in reality not possible to give a satisfactory explanation of the complete defect in the contrast shadow, corresponding to the caecum and ascendens, which was shown in STIERLIN's cases.

It is now also shown in practice that the Stierlin sign is far from being present in all cases. Among the German roentgen scientists, with regard to STIERLIN's famous name, there has perhaps been shown a certain reserve in the criticism of this roentgen finding to which such great diagnostic value has been ascribed. But the remarkable silence in the literature on this point is, in any case, certainly not owing to (as FAULHABER means) the sign among roentgen scientists being looked upon as an established matter of fact, and therefore not valuable for further reports. For there is certainly no doubt about it that most who have sought after this

sign are sadly disappointed, and FAULHABER's utterance appears so much more remarkable as FAULHABER himself establishes that STIERLIN's sign can be lacking with ileocaecal tuberculosis, or cancer definitely known to be present. It has certainly been for most as it has been for REVÈCZ who, in spite of his continually getting all cases sent from a tubercular hospital, in which the symptoms present, besides tubercular lung changes, continually suggested a possible ileocaecal tuberculosis, yet through long periods never once met with the STIERLIN sign. As there cannot be any talk of a technical mistake, because the recognition of the sign is so easy, R. meant that the cause of the absence of the sign was to be found in the fact that there certainly were many ileocaecal diseases which did not give STIERLIN's sign, and R. is certainly right in this.

FAULHABER published in 1917 two cases where the STIERLIN sign was absent, in spite of one being absolutely obliged to meet with it, if STIERLIN's declarations are right. In the one case the whole caecal wall showed itself infiltrated with cancer, and the intestine transformed to a stiff pipe. The other showed by operation an infiltrated medial caecal wall with tubercular ulcerations here, and, in addition, tuberculous ulceration in the ileum.

When two such definite examples with the path. anat. changes which should develop STIERLIN's sign can fail, the great diagnostical value, which STIERLIN and after him also SCHWARZ have ascribed to the sign, is reduced to a considerable degree. Fortunately, however, the changes in the roentgen picture of the intestine offer in such cases other possibilities for diagnosis in the right direction, which is very beautifully and precisely defined by FAULHABER on the basis of the two cases named, and these changes show themselves as: changes of the size of the caecum-ascendens shadow, its shape and its speed of emptying. As diagnostical signmarks the following are advanced which were all found in the two cases mentioned, namely,

- 1) A pathological diminution in size of the shadow of the caecum-ascendens.
- 2) Abnormal shape and contour of it, in analogy with the shadow defects in ventricle cancer.
- 3) An inexpandibility, stiffness of the wall and
- 4) Increased speed of emptying.

The size of the shadow of the caecum-ascendens is certainly very different, but it could well enough in general be said to be the most spacious part of the large intestine. The recognition of an abnormal diminution in the shadow of the caecum-ascendens will thus as a rule not cause any difficulty, especially as in general the pathological enlar-

gements of the organ play the chief part. A hypertony of the intestine will never give such extreme diminutions of the organ as is here talked of, and could be separated from these owing to the deep haustral contractions which are found in hypertonic cases. It is important to know that, to produce such a typically diminished shadow of the caecum-ascendens as is here talked about, a total infiltration of the wall need not necessarily be found. An infiltration of the one side of the wall is already sufficient, which FAULHABER's case number two showed.

When an abnormal contour is added to such a diminution of the shadow, the diagnosis gains in certainty. However, one must pay due regard to the very different appearances which the shadow of the caecum-ascendens can have.

Only through the persistence of abnormal changes or defects in the contours, as seen by repeated examinations, can one come to a definite conclusion. Moreover, a control examination by contrast enema is absolutely necessary.

The inexpansion of the wall is confirmed by the contrast enema examination. To exclude spasmodic conditions this should perhaps take place after administration of papaverin.

Finally, according to FAULHABER, the diagnosis will be further ensured by the substantiation of an abnormally quick emptying of the caecum-ascendens. Should thus, for instance, the caecum only be contrast-filled for 5-6 hours as against the normal 16-20 hours, this finding will further contribute to ensure the diagnosis, and only the presence of profuse diarrhoea weakens this sign.

Besides FAULHABER's two cases, GOLDAMMER has reported one case where STIERLIN's sign was lacking. Likewise REVÈCZ, whose cases confirm in a beautiful way the changes which FAULHABER has described as characteristic for the condition.

With these writers I find myself in agreement. It has never been at any time my fortune to observe any STIERLIN sign. And when the sign in a case which I recently had the opportunity to examine at Frederiksberg Hospital Roentgen Department also failed, and where a later post-mortem showed a very widespread ileocaecal tuberculosis, I took upon myself to examine how the position really stands as to the reliability of STIERLIN's sign.

The case was that of a 21-year-old bank assistant who, for the first time, was an in-patient in the Frederiksberg Hospital Tubercular Department (Dr Permin) on the 7th of January, 1920. No tuberculosis in the family. The youngest of a family of six, all of whom had been and were well. He was well as a child and during the growing period. In 1918 he had pleuritis for which he kept his bed for two and a half months. Thereafter completely healthy until February, 1920, when he got

symptoms which indicated gastric catarrh. He felt tired, perspired a little at night, and got thin. Changes were found in both lungs, mostly in the left + Tb in expect. Achylia gastrica was found.

A roentgen picture of the lungs showed very closely placed infiltrations in the upper-half part of both lungs. He recovered fairly during his stay and was discharged for sanatorium treatment. During his stay here the case was worse, he lost weight. From



the middle of September, 1920, his abdominal pain again began to inconvenience him. There came pains of a colicky character, and a tendency to constipation. The temperature rose. He had to remain in bed. Nausea and vomiting came for which he had to be an in-patient again in the hospital on 12/11/20. Stethoscopy of the lungs showed no sign of anything being worse, but, on the contrary, better. There was no blood or mucous in the evacuation, which was often hard and lumpy, though steadily changing to diarrhoea tendency. There were continual pains and disturbances in the abdomen, and it was the opinion that it was a question of ileocaecal tuberculosis, and it was also the opinion that a resistance could be felt in the right fossa iliaca. The abdomen was now and then a little distended, and he had continually to have oil to keep the evacuations in order. Expl. rectalis showed nothing abnormal. On Dec. 20th the patient had *roentgen examination*. Two examinations took place which both gave quite the same picture and the intestine was examined 5 hours and 12 hours after the contrast meal (Fig.). The caecum-ascendens shadow was found considerably reduced in breadth as well as in length. The middle wall of the caecum showed patholog. changes, as the contour was as if frayed and full of holes, and the lowest part of the caecum likewise showed defects consisting of holes in the shadow. Yet 14 hours after the contrast meal the lowest part of ileum was filled. The lowest part of the ileum was seen as an irregular narrow strip leading towards the caecum and keeping itself unchanged in this appearance. The opinion from the picture was that one could conclude that in the caecum-ascendens there were to be found infiltrative ulcerative processes, which had developed a stricture at the ileocaecal junction, and that likewise the lowest part of the ileum was heavily infiltrated. And taking the anamnesis into consideration all undoubtedly was due to tubercular changes. When the abdominal symptoms quite suddenly became worse, the patient was placed in the surgical department, where, however, one was not of the opinion that the case was suitable for surgical treatment. As the pains and vomiting con-

tinually increased, a roentgen treatment of the tubercular peritonitis was tried, without effect, however. The patient quickly collapsed and died on Feb. 10th, 1921. The post-mortem (Dr. Stamer) showed besides an old fibrous pthisis, the caecum strongly adherent down in the right fossa iliaca. A tumour was found, about the size of a tangerine, in the caecum, formed of the strongly hypertrophied wall, localised just within valvula Bauhini. The lowest part of the ileum was partly in the tumour formation, the lumen was here strongly restricted. The mucous membrane almost ulcerated away. Ulcerations were likewise found in the caecum and colon ascendens and in colon transversum. In addition, typical tubercular ulcerations were found widespread in the colon and ileum.

As it is seen, the STIERLIN sign in this case of notorious ileocaecal tuberculosis also failed. The changes found in the roentgen picture, on the contrary, completely correspond to the changes which FAULHABER describes as characteristic for the condition. My case only shows that one dare not ascribe to the quick emptying of the caecum-ascendens so great a meaning as FAULHABER ascribes to it, as ulcerations or infiltrations about the ileocaecal valve certainly very often give stenosis here and in consequence thereof a delayed emptying of the small intestine, for example, in my case 14 hours after the contrast meal there was still a continual emptying of the contrast contents into the caecum.

Thus since STIERLIN's announcement in 1911 there have only been 7 cases published of observed »STIERLIN Sign» in medical literature, while now in 5 cases¹ there can be reported absence of the sign, in cases where one should absolutely expect to meet with it. The prominent diagnostic value and absolute infallibility which STIERLIN ascribes to the sign is therefore a long way from being confirmed.

When one takes into consideration the relative frequency of ileocaecal conditions, it must (as already said) also appear very striking that so few cases are made public, if the sign really has the value which STIERLIN has attributed to it. I believe that in reality this defect in the contrast shadow in the caecum-ascendens is but rarely seen. The abnormal shape and contour of the shadow of the caecum — ascendens is analogous to the shadow defects in, for instance, a cancerous stomach. The shrinking of the piece of the intestine and the stiffness of the wall corresponds also more naturally with the commonly known picture of tumour formation in the digestive tract, and it is my conviction that these changes, if the conditions in question were more frequently the object of report by roentgen scientists, would be shown to be those most commonly occurring. In cases where these changes are found, it is therefore not legitimate to speak about a negative STIERLIN sign.

But, of course, one should still consider the possibility, that quite early

¹ I have later observed a case of notorious caecal cancer, where the sign also failed, consequently now 6 cases in all.

cases of ileocaecal tuberculosis (and also other conditions of the ileocaecal region described here) *can* be shown in the roentgen picture by the absence of contrast-filling of the particular section of the intestine, even though in my experience one will get the opportunity relatively seldom to observe this picture.

Summary

The so-called »Stierlin Sign» in ileocaecal tuberculosis has not the great diagnostic value which STIERLIN has ascribed to it. It is certainly a relative rarity.

The roentgen picture of ileocaecal tuberculosis, and the other tumour-producing complaints in the ileocaecal region, commonly corresponds to the well-known picture of other tumour formations in the digestive tract, and has as diagnostical signmarks:

- 1) a pathological diminution of the shadow of the caecum-ascendens,
- 2) an abnormal shape and contour of it, in analogy with the shadow defects in cancer ventriculi and
- 3) an inexpansibility and stiffness of the intestine wall.

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Das Nischensymptom bei Carcinoma ventriculi*

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(Tabula XVIII)

Die röntgenologische Differentialdiagnose zwischen Ulkus und Carcinoma ventriculi kann für die grosse Mehrzahl der Fälle nicht als schwierig bezeichnet werden. Die beiden Affektionen geben ja in typischen Fällen gerade entgegengesetzte röntgenologische Lokalzeichen: Der Ulkuskrazer verursacht eine nischenförmige Ausbuchtung auf dem Magenschatten, einen Gebietszuwachs desselben, ein Plus, das Karzinom dagegen eine mehr weniger unregelmässige Einbuchtung im Kontrastschatten, einen Defekt, ein Minus.

Nicht gar so selten trifft man indes auf Abweichungen von diesem typischen Verhalten: ab und zu markieren sich Ulzera röntgenologisch ausschliesslich oder vorzugsweise als Füllungsdefekte und in selteneren Fällen bilden deutliche und schöne Nischenbildungen den einzigen oder hauptsächlichen Befund bei Karzinom. Es ist diese letztgenannte Gruppe von Fällen, die *kraterförmigen Ventrikelkarzinome* also, mit welchen ich mich hier etwas näher beschäftigen möchte, da röntgenologische Fehldiagnosen bei derartigen Affektionen sehr verhängnisvoll werden können.

So lange der röntgenologische Nischenbefund bei Ulcus ventriculi als Operationsindikation galt, war vielleicht eine Fehldiagnose solcher Krebsfälle von geringerer Bedeutung, da vielfach die Diagnose bei der Laparotomie richtiggestellt und in geeigneten Fällen die Resektion vorgenommen werden konnte. Die schönen Untersuchungsergebnisse der letzten Jahre auf dem Gebiete der internen Ulkustherapie, vor allem von ÖHNELL (1) in unserer Heimat, sowie von HAMBURGER (2) in Chicago und WHITE (3) in Boston haben indes gezeigt, dass Ulkussen in vielen Fällen

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ausserordentlich dankbare Objekte für die interne Behandlung sind und dass durch energische und lang fortgesetzte Behandlung dieser Art nicht selten eine beträchtliche Verkleinerung oder ein völliges Verschwinden der Nischen und gleichzeitig der übrigen klinischen Symptome und subjektiven Beschwerden erzielt werden kann.

Seit es nach diesen Untersuchungen bei uns ziemlich gewöhnlich worden ist, verschiedene Formen nischenförmiger Ventrikelgeschwüre intern zu behandeln, ist die Verantwortung bei der röntgenologischen Nischendiagnose beträchtlich gewachsen: in jedem Fall von röntgenologischer Nischenbildung im Ventrikel muss sich der Röntgenologe unbedingt die Frage stellen: Kann hier nicht vielleicht ein kraterförmiges Karzinom vorliegen, das ein Ulkus vortäuscht, ein nischenförmiges Krebsgeschwür?

Ein kraterförmiges Ventrikelkarzinom oder ein kraterförmiges Ventrikelgeschwür mit Krebsgewebe an den Rändern oder am Boden des Geschwüres kann man sich auf verschiedene Weise entstanden denken und unter den Pathologen wie unter den Klinikern finden sich die verschiedensten Ansichten sowohl über die Häufigkeit des Vorkommens der verschiedenen Entstehungsarten als über die Häufigkeit der Affektion überhaupt.

Man kann entweder an eine sekundäre *karzinomatöse Degeneration* eines chronischen *Ulcus simplex* denken, — ein »*Carcinoma ex ulcere*« — oder es handelt sich um ein *primäres Karzinom* mit Ulzeration.

Man hat alle möglichen Frequenzzahlen für das »*Carcinoma ex ulcere*« angegeben. Nach ZENKER entstehen sämtliche Ventrikelkrebse auf diese Weise. Nach WILSON und MC CARTY (4) zeigten 71 % der auf der Klinik Mayo resezierten oder exziierten, sicheren Ventrikelkarzinome so deutliche makro- oder mikroskopische Zeichen eines vorhergehenden Ulkus, dass den Verfassern die Annahme berechtigt erscheint, dass sich diese Karzinome auf der Basis eines früheren Ulkus entwickelt hätten. MOYNIHAN (5) nahm auf Grund seines Operationsmaterials eine Entwicklung von Ventrikelkrebs auf Ulkusbasis in 66 % der Fälle an, PAYR (6) in 26 %. HAUSER (7, 8), der 1883 der Ansicht war, dass chronische Ulzera in 5—6 % der Sitz eines Karzinoms würden, sprach sich 1910 ungemein vorsichtig darüber aus; er war immer noch der Meinung, dass ein »*Carcinoma ex ulcere*« in sehr seltenen Fällen vorkommen könne, hält es aber für durchaus verfrüht, eine bestimmte Auffassung über ihre Frequenz zu äussern. ASCHOFF (9) meinte 1911, dass man mit der Diagnose »*Carcinoma ex ulcere*« nicht genug zurückhaltend sein könne. Einzelne Verfasser, HIRSCHFELD (10), DRUMMOND und MORRISON (11) haben jeden Zusammenhang zwischen Ulkus und Karzinom bestritten. AAGE NIELSEN (12) hat letzthin in einer grösseren kritischen Arbeit, wie mir scheint, mit Recht die Auffassung geltend gemacht, dass der »Uluskrebs« ein primärer Krebs sei, der 4—5

Jahre, vielleicht noch länger bestehen könne, und der durch einen längeren oder kürzeren Teil seiner Verlaufszeit ein *Ulcus simplex* vortäusche.

Eine Ulzeration eines primären Magenkrebses kann auf verschiedene Weise zustandekommen, am gewöhnlichsten durch Gefässverschluss und Nekrose; rein peptische Geschwüre auf langsam wachsenden Ventrikelkarzinomen sind von KAUFMANN (13) beschrieben worden. TRIPIER (14) und DUPLANT (15) haben eine besondere, dem *Ulcus rodens* der Haut analoge Form des Magenkrebses beschrieben: Neubildung und Ulzeration halten bei derselben miteinander nahezu gleichen Schritt und oft kann es infolge der Ulzerationen sehr schwer werden, selbst mikroskopisch, Tumorgewebe an den Geschwürsrändern nachzuweisen. Meiner Meinung nach ist es diese »*Ulcus rodens*-ähnliche» Form des Carcinoma ventriculi, die röntgenologisch ein *Ulcus ventriculi* am häufigsten und am leichtesten vortäuscht.

Die Angaben, die ich in der Röntgenliteratur über »Karzinomnischen» oder »Karzinomdivertikel» gefunden, sind sehr sparsam und mehrere der mitgeteilten Fälle sind meiner Ansicht nach recht unsicher oder jedenfalls nicht beweisend.

Ungefähr ein Jahr nach der ersten Publikation HAUDEKS (16) über die charakteristischen Nischenbilder bei penetrierendem Ulkus teilten STRAUSS und BRANDENSTEIN (17) einen Fall mit analogem Röntgenbefund mit (Sanduhrmagen mit einer grösseren, ovalen, gasblasengekrönten Nischenbildung in der *Curvatura minor*), bei dem die Operation einen apfelgrossen, mit dem Pankreas verwachsenen Tumor in der *Curvatura minor* ergab, den die Verfasser als Karzinom ansahen. Vom Magen aus wurde im Pankreas eine grössere Penetrationshöhle palpiert, die durch eine runde, fingerbreite, scharfrandige Öffnung mit dem Magen kommunizierte. Peritoneum sukkulent, feucht, »ganz wie im Vorstadium karzinomatöser Peritonitis».

Schon im nächsten Jahr besprach STRAUSS (18) einen weiteren ähnlichen Fall (ovale, 3×2 cm grosse Nischenbildung in der *Curvatura minor* mit dreischichtigem Mageninhalt und stielförmigem Verbindungsstück), wo bei Laparotomie ein Tumor konstatiert wurde, der die Magenwand breit infiltrierte und mit der Umgebung verwachsen war, ferner eine Anzahl vergrösserter Drüsen in perigastrischem Gewebe um den Pylorus herum und ödematöse Schwellung und Rötung der Serosa in der Umgebung des Tumors, was als Anzeichen einer beginnenden karzinomatösen Peritonitis aufgefasst wurde.

Die in diesen beiden Fällen lediglich auf Grund des Laparotomiebefundes gestellte Karzinomdiagnose macht einen sehr wenig überzeugenden Eindruck. Mikroskopische Untersuchung sowie Angaben über den späteren Verlauf fehlen in beiden Fällen. Es ist mir sehr wahr-

scheinlich, dass es sich in diesen beiden Fällen von — wie es scheint — typischen penetrierenden kallösen Ulkurnischen um entzündliche Pseudotumoren gehandelt hat. HAUDEK (19) hat mitgeteilt, dass er mehrmals derartige Fälle gehabt, wo die röntgenologische Ulkusdiagnose bei der Laparotomie auf die Diagnose Carcinoma abgeändert worden, wo aber der spätere Verlauf während einer vieljährigen Beobachtungszeit die Richtigkeit der Röntgendiagnose erwies. Dass ähnliche, *nicht* klargestellte Fälle dann ein über das anderemal zitiert werden und man sich in der Fachliteratur auf sie beruft, um die Unmöglichkeit einer röntgenologischen Differentialdiagnose zwischen Ulcus simplex und Ulcus carcinomatosum zu illustrieren, ist natürlich gänzlich verfehlt und trägt nicht dazu bei, die Lösung der Frage näher zu bringen.

Am 9. Röntgenologenkongress 1913 in Berlin berichtete HOLITSCH (20) über 4 Fälle von »Ulkuskarzinom« mit röntgenologischer Nischenbildung, welche mit einander gemeinsam hatten, dass die Nische von einem flachen, schildförmigen Füllungsdefekt umgeben war, welcher die Nische gleichsam in den Magenschatten hineinpresste, so dass sie nicht über das Niveau der Curvatura minor hinausragte. HOLITSCH sah in diesem umfassenden schildförmigen Füllungsdefekt eine Möglichkeit zur Differenzierung zwischen karzinomatösen und kallösen Geschwüren.

KÖPFERLE (21) hob in der darauffolgenden Diskussion hervor, dass eine schildförmige Einsenkung in der Umgebung eines Ulkus an und für sich nicht zur Annahme eines Ulcus carcinomatosum berechtige; eine ähnliche Veränderung, verursacht durch eine Perigastritis könne in der Umgebung von reinen Ulkurnischen beobachtet werden.

Auch eine lokale spastische Kontraktion in der Umgebung einer reinen Ulkurnische kann — meiner Ansicht nach — ein gewisses Einpressen der Nische in den Magenschatten bewirken.

HAUDEK (19) bezeichnete die röntgenologische Differentialdiagnose zwischen Ulkus und Ulkuskarzinom als »im ganzen sehr unsicher« und riet den Röntgenologen, wenn sie keine Fehldiagnose riskieren wollten, zum Befunde bei einer Nische die Deutung hinzuzufügen: tiefgreifendes Magengeschwür *oder* Karzinom auf der Basis eines solchen.

STIERLIN (22) beschrieb ein paar Fälle von »Karzinomdivertikel«. Nach STIERLIN wäre das Krebsgeschwür grubenförmig, seicht, mit wallförmigen und unregelmässigen Rändern, weshalb die Entscheidung gewöhnlich nicht schwer sei.

CARMAN (23) wies darauf hin, dass er von Symptomen, die geeignet wären, Verdacht auf Malignität zu erwecken, nur eine auffallende Grösse des Nischendurchmessers gefunden habe. Unter den grösseren Nischen CARMANS mit einer Breite von 3—4 cm, hatten sich bei der mikroskopischen Untersuchung einige wenige als bösartig erwiesen.

Einen Fall von nischenförmigem Karzinomdivertikel an der Curvatura minor teilte kürzlich EMIL MÜLLER mit (24); bei der Operation fand sich ein grosses infiltrierendes Karzinom an der ganzen Curvatura minor, von der Cardia bis zum Pylorus.

Da vor nicht gar langer Zeit in der Fachliteratur hervorgehoben wurde — SCHLESINGER (25) — dass weitere Beiträge zur röntgenologischen Kasuistik der karzinomatösen Ulcera ventriculi ausserordentlich wünschenswert wären, dachte ich, dass eine Mitteilung der hiehergehörigen verifizierten Fälle, die ich im Laufe einiger Jahre gesammelt, von einigem Interesse sein könnte.

Ich bringe im Folgenden zunächst die Beschreibung dieser Fälle.

Fall I. G. D., Telefonarbeiter, 40 Jahre. Seit 2 Monaten Magenbeschwerden, Schmerzen in der Magengrube, unmittelbar nach der Mahlzeit. Kein Erbrechen. Probefrühstück: T. A. 18, freie Salzsäure 7. Faeces: Weber pos. — Klin. Diagn.: Ulcus ventriculi.

Röntgenuntersuchung $10/5$ — 18. In der Gegend des Pylorus an der Curv. minor ein haselnussgrosser, nischenähnlicher Schatten, (Fig. 1); derselbe entspricht einer palpablen Resistenz, über welcher Druckempfindlichkeit besteht. Das Pylorusgebiet zeigt verminderte Verschiebbarkeit. Peristaltik normal, bei der Durchleuchtung vergrösserte Entleerungsgeschwindigkeit. Handbreite Intermediärschicht. Ein deutlicher Zusammenhang zwischen der Rezessbildung und dem Ventrikel konnte wegen des umgebenden wallförmigen Defektes nicht beobachtet werden; dagegen schien die Rezessbildung mit dem Bulbus zusammenzuhängen, weshalb mit einem penetrierenden Duodenalgeschwür, event. mit einem Divertikel als wahrscheinlichem Befund gerechnet wurde.

Operation $5/6$ — 18. (Dr. GRAMÉN). Auf der oberen hinteren Fläche des Ventrikels nächst dem Pylorus, eine taubeneigrosse Infiltration mit zentralem, fingerspitzen-grossem Geschwürskrater. Die Geschwürsränder unregelmässig und wulstig aber nicht hart. Omentum minus verdickt und gespannt. In der Umgebung einige Drüsen, nicht besonders hart. Karzinom konnte nicht ausgeschlossen werden. — Resektion + G.-E. r. p. *Path.-anat. Diagnose:* Ulcus carcinomatosum.

Fall II. K. P., Eisenarbeiter, 61 Jahre. Magenschmerzen seit einem halben Jahre. Kein Erbrechen. In der Gegend des Nabels und des 1. Hypochondriums ein stark empfindlicher Tumor palpabel, 12 St.-retention, Achylie. — Klinische Diagn.: Carcinoma ventriculi.

Röntgenuntersuchung $10/5$ — 19. An der Curvatura minor in der Nähe des Pylorus eine mandelgrosse, nischenähnliche Ausbuchtung (Fig. 2 a), umgeben von einem zirkulären, wallartigen, bei Kompression (Fig. 2 b) deutlich hervortretenden Füllungsdefekt, der dem palpablen Tumor entsprach. Keine Bulbusdeformierung. Bei der Durchleuchtung Hyperperistaltik und Hypermotilität, kleine 4 St.-retention. — Röntgen-diagnose: Ulcus carcinomatosum ventriculi.

Operation $11/5$ — 19. (Dr. MICHAËLSON). Der palpierbare Tumor im Canalis unmittelbar am Pylorus gelegen, auf den er jedoch nicht übergriff, gegen die Umgebung leicht verschieblich. Dünne, fibröse Adhärenzen zwischen dem Tumor und der vorderen Bauchwand. Im Omentum majus zwei haselnussgrosse, weiche Drüsen. — Resektion + G.-E. v. p. — Das Resektionspräparat zeigte ein mandelgrosses, oval kraterförmiges Geschwür mit harten tumorinfiltrierten Rändern (Fig. 3).

Pathol.-anat. Diagnose: Carcinoma medullare. In den Drüsen kein Karzinom.

Fall III. R. H., Schuhmacher, 73 Jahre. Seit 3 Monaten Magenbeschwerden mit Schmerzen mehrere Stunden nach der Mahlzeit und des Nachts. Schlechter Appetit, keine Übelkeiten, kein Erbrechen. Bedeutende Abmagerung. Rechts, im Epigastrium eine unebene, etwas empfindliche Resistenz. — Klin. Diagn: Carcinoma ventriculi.

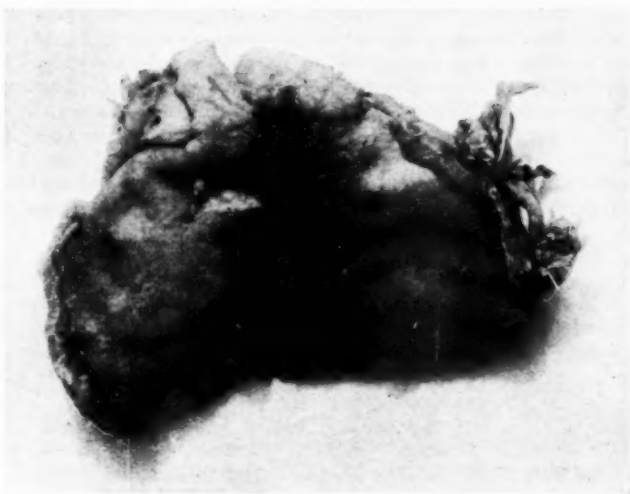


Fig. 3.

Röntgenuntersuchung $14/8-19$. Gut mandelgrosse,

konstante, nischenähnliche Ausbuchtung an der Curvatura minor, unmittelbar am Pylorus, entsprechend einem palpablen, relativ beweglichen Tumor (Fig. 4). Gegenüber dieser Ausbuchtung eine konstante Einziehung an der Curvatura major. Ventrikel erweitert; unbedeutende Peristaltik. Pylorus tritt nie deutlich hervor, unbedeutende Austreibung ins Duodenum während der Durchleuchtung, grosse 4 St.-retention. — Röntgendiagnose: Ulcus carcinomatosum ventriculi.

Operation $22/8-19$. (Prof. Dr EKEHORN): Im Pylorusgebiet ein Tumor. — Resektion + G.-E. r. p. + E.-A. — Nach Aufschneiden des Präparates zeigte sich eine Ulzeration an der hinteren Ventrikelwand, unmittelbar am Pylorus. Geschwürsgrund hart, Geschwürsränder aufgeworfen, infiltriert. An dem Platze des Tumors starke Verwachsungen mit der hinteren Bauchwand.

Path.-anat. Diagnose: Ulcus carcinomatosum.

Fall IV. K. G., Kollege, 57 Jahre. Im letzten Jahre Magenbeschwerden, die als Ulkus aufgefasst wurden, und sich durch Bettruhe und Ulkusdiät besserten. Hungerschmerzen und nächtliche Schmerzen. Druckempfindlichkeit im Epigastrium in der Mittellinie. Normale Aziditätswerte. Faeces: Weber pos. — Klin. Diagn.: Ulcus ventriculi.

Röntgenuntersuchung $21/8-20$. Kleiner Ventrikel mit einer breiten, inkonstanten Einziehung an der Curvatura major im unteren Teil des Korpus. An der entsprechenden Stelle war die Curvatura minor in einer Ausstreckung von ca. 2 cm steif und etwas uneben und auf ein paar Platten trat hier eine kleine zelt- oder zackenförmige Ausbuchtung hervor. Keine Retention nach 4 Stunden. — Da Karzinom nicht ausgeschlossen werden konnte, wurde dem Pat. geraten, nach kurzer Zeit zu einer Kontrolluntersuchung wiederzukommen.

Röntgenuntersuchung $11/8-20$. An der Stelle der früherbeschriebenen zeltförmigen Ausbuchtung jetzt eine seichte, gerundete Nischenbildung, im Ausmasse von 2 mm in die Tiefe und 10 mm längs der Curvatur, die retrahiert war (Fig. 5). Leichte Druckempfindlichkeit über der Nische.

Operation $4/_{10}$ —20. (Dr. KEY). In der Curv. minor ein kraterförmiges Karzinom. Unter dem Peritoneum viscerales Karzinomvegetation bis hinauf zur Kardie. Fixation am Pankreas, längs dessen oberem Rand vergrösserte Drüsen. Im Omentum majus kleinere Knötchen, von welchen eines behufs mikroskop. Untersuchung exzidiert wurde.

Path.-anat. Diagnose: Karzinom.

Fall V. K. H. H., Kollege, 64 Jahre. 30 Jahre dauerndes Ulkuseiden mit wiederholten Magenblutungen. Vor 11 Jahren G.-E. r. p., vor 7 Jahren Lösung von Adhärenzen und Exklusio pylori. Andauernde periodische Ulkusbeschwerden. Im letzten Jahre müde und matt, dunkle Stühle, Blut wiederholt in Faecesproben nachgewiesen. — *Klin. Diagn.:* Ulcus ventriculi.

Röntgenuntersuchung $17/_{5}$ —20. G.-E.-magen. Durch den Pylorus entleerte sich eine minimale Menge Kontrastinhalt in einem kaum merkbaren, äusserst dünnen Streifen. Im Gebiete des Angulus die Kontur steif und eine unbedeutende, nicht druckempfindliche zeltförmige Ausbuchtung sichtbar, von der man annahm, dass sie »wahrscheinlich auf Basis eines Ulkus zustande gekommen war« (Fig. 6). Minimale Retention nach 4 Stunden. — Dem Pat. wurde empfohlen, nach kurzer Zeit eine neuerliche Röntgenuntersuchung vornehmen zu lassen, er verschob dieselbe aber infolge seines subjektiv guten Befindens während der Ulkusbehandlung.

Röntgenuntersuchung $18/_{1}$ —21.¹ Grosser, fetziger Tumorddefekt, hauptsächlich der Curvatura minor und dem Korpus angehörig und tief in das Ventrikellumen einbuchend. Auf Platten in Bauchlage zeigt sich immer noch eine kleine nischenähnliche Ausbuchtung im Angulusgebiet, unmittelbar unterhalb des grossen fetzigen Tumorddefektes.

Operation $20/_{1}$ —21. (Prof. Dr. EKEHORN). Beinahe unmöglich in die freie Bauchhöhle zu gelangen infolge alter Adhärenzen. Es konnte jedoch konstatiert werden, dass der Ventrikel der Sitz knolliger Tumormassen und an die Leber fixiert war.

Der Pat. starb wenige Monate später nach zunehmender Kachexie.

Fall VI. E. M. B., Fräulein, 40 Jahre. Im letzten Jahre ulkusähnliche Magenbeschwerden. Vor 4 Monaten anderwärts röntgenuntersucht, mit negativem Resultat.

Probefrühstück: T. A. 48. Kongo +; Faeces: Weber pos. — *Klin. Diagn.:* Ulcus ventriculi (?).

Röntgenuntersuchung $16/_{10}$ —20. Hoch oben an der Rückseite des Ventrikels unmittelbar an der Curvatura major eine ovale, dattelgrosse, scharf begrenzte Nischenbildung, der Palpation unzugänglich (Fig. 7). In der Umgebung der Nische ein kreisförmiger, unregelmässiger Füllungsdefekt, einen intensiven Infiltrationsprozess um den Geschwürskrater andeutend. Eine sichere Diagnose liess sich nicht stellen, doch hielt man ein chronisches kallöses Ulkus für das wahrscheinlichste. Krebs konnte aber nicht ausgeschlossen werden.

Operation wurde vorgeschlagen, aber vom Chirurgen abgelehnt wegen Auftretens eines harten, knolligen Drüsenpakets in der linken Fossa supraclav., das als Krebsmetastase aufgefasst wurde.

Röntgenuntersuchung $24/_{11}$ —20. Füllungsdefekt seit dem letztenmale bedeutend vergrössert, umfasst jetzt einen grossen Teil des Fornix und den oberen Teil des Corpus ventriculi. Der Tumorcharakter des Prozesses war jetzt ausser Zweifel.

Nach zunehmender Kachexie Tod nach einigen Monaten.

Fall VII. A. L. A., Frau, 67 Jahre. Seit einem halben Jahre zunehmende Magenbeschwerden mit leichten Schmerzen nach der Mahlzeit. Probefrühstück: Kongo — Uffelmann angedeutet. — *Klin. Diagn.:* Carcinoma ventriculi?

Röntgenuntersuchung $27/_{1}$ —21. In der Curv. minor eine dattelgrosse, breitbasige,

¹ Diese Untersuchung wurde von Prof. Dr. G. Forssell ausgeführt, der mir die Platten gütigst zur Verfügung stellte.

nischenförmige Ausbuchtung; derselben gegenüber in der *Curvatura major* ein grosser Füllungsdefekt, eine sanduhrförmige Verengung an einem ungefähr handbreiten Gebiete verursachend (Fig. 8). *Curvatura minor* sowohl oberhalb als unterhalb der Nische steif, und in grosser Ausdehnung infiltriert. Der Magen war gut verschiebbar und die Möglichkeit einer Resektion erschien nicht ganz ausgeschlossen. Röntgendiagnose: Carcinoma ventriculi.

Operation ^{31/1}—21. (Dr. Kev). Zirkulärer Karzinomtumor im Corpus ventriculi, von nahezu doppelter Faustgrösse, gut beweglich. Unbedeutende Drüsen. Im Ligamentum gastro-colicum und im Omentum majus kleine Krebsknollen, weshalb von der technisch möglichen Exstirpation Abstand genommen wurde.

*

Das Auftreten von Nischen bei älteren, bis dahin magengesunden Personen nach einer relativ kurzdauernden Periode von Beschwerden ist meiner Ansicht nach immer als ein gebieterisches »Habt Acht« aufzufassen, das den Verdacht auf Karzinom nahelegt. Das Vorhandensein von normalen Aziditätswerten darf über diesen Verdacht nicht hinwegtäuschen und den Röntgenologen nicht in Sicherheit wiegen. (Vgl. Fall IV und VI).

Nach meinem eigenen hier mitgeteilten Material zu urteilen, scheint bei Krebsgeschwüren sowohl die Lage als die Form und das palpatorische Verhalten einer röntgenologisch nachgewiesenen Ventrikelnische gewisse Anhaltspunkte für die Annahme eines malignen Charakters der Nischenbildung zu geben.

Atypisch lokalisierte Korpusnischen, wie an der *Curvatura major* (Fall VI) und grössere, präpylorische Nischen (Fall I, II, III), scheinen mir besonders suspekt.

Das Auftreten einer mehr minder ausgesprochenen, oft unregelmässigen, wallförmigen Einbuchtung oder plateauartigen Einsenkung in der Umgebung der Nische (Fall I, II, VI) — welche Wallbildung man durch direkte Kompression des Nischengebiets mittels Luffaschwamm deutlicher zum Vorschein bringen kann (Fall II) und der nicht selten ein harter, palpabler Tumor entspricht (Fall I, II, III) — verstärkt den Verdacht auf einen malignen Charakter der Nischenbildung noch mehr, und ebenso eine Steifheit der Magenwand in einem grösseren oder kleineren begrenzten Gebiet in der Umgebung der Nische (Fall IV, V, VII).

Was ihre Form betrifft, waren die von mir beobachteten Krebsnischen im allgemeinen breitbasig oder zacken- und zeltförmig. Eine Gipfelgasblase hat sich in diesen Nischen nicht gefunden. Ein stielförmiges Verbindungsstück oder ein schmaler Geschwürrhals, oft zum grossen Teil bedingt durch eine Kontraktion der die Nische umgebenden Muskulatur, spricht meiner Meinung nach gegen die Annahme eines karzinomatösen Geschwüres.

Die Grösse der Nischen variierte bei meinem Material zwischen der einer Dattel und eines Dornes.

Wie aus meiner Kasuistik hervorgeht, war es in 3 von den 7 Fällen

möglich, schon bei der ersten Untersuchung, rein röntgenologisch die Diagnose *Ulcus carcinomatosum ventriculi* resp. *Carcinoma ventriculi* zu stellen; in weiteren 2 Fällen wurde bei der ersten Untersuchung ausdrücklich darauf hingewiesen; dass Karzinom nicht ausgeschlossen werden könne. In einem der Fälle, einem alten, sicheren, operativ behandelten Ulkusleiden, das sich über drei Dezennien erstreckt hatte, konnte die Krebsdiagnose nicht bei der ersten Röntgenuntersuchung gestellt werden, sondern erst bei einer späteren, leider mehr als ein halbes Jahr aufgeschobenen, und von anderer Seite ausgeführten Kontrolluntersuchung, in einem Zeitpunkt, in dem die operative Entfernung, weil aussichtslos, bereits ausgeschlossen war. Der übrigbleibende Fall — der erste — war ganz falsch gedeutet, da die Nischenbildung als vom *Bulbus duodeni* ausgehend aufgefasst wurde, und es kam niemals zur Stellung einer definitiven Röntgendiagnose. Die klinische Diagnose vor der Röntgenuntersuchung hatte in 4 von den Fällen: *Ulcus ventriculi* und in 3 Fällen: *Carcinoma ventriculi* gelaute¹.

Zusammenfassung

Die vielfach immer mehr in Anwendung kommende interne Behandlung nischenförmiger Magengeschwüre bringt eine erhöhte Verantwortlichkeit für den Röntgenologen bei der Deutung nachgewiesener Ventrikelnischen mit sich.

Nach einem Referat über die ziemlich spärliche, einschlägige Röntgenlitteratur wird über 7 Fälle von nischenförmigem, karzinomatösen Magengeschwür berichtet, die im Zeitraum einiger Jahre zur Beobachtung gekommen waren. In dreien dieser Fälle war bei der erstmaligen Röntgenuntersuchung die richtige Diagnose gestellt worden, in zwei weiteren ausdrücklich darauf hingewiesen worden, dass Karzinom nicht ausgeschlossen werden könne.

Es kann vorkommen, dass die Aziditätsbestimmung bei nischenförmigen Krebsgeschwüren normale Werte gibt. Das Auftreten von Nischen bei älteren, bis dahin magengesunden Personen ist als eine ernste Warnung aufzufassen; atypische Nischenlokalisation ist gleichfalls auf Karzinom verdächtig. Durch Nachweis einer harten, steifen, wall- oder plateauartigen Infiltration in der Umgebung der Nische — welche Infiltration

¹ Nachtrag bei der Korrektur: Nachdem das Obige geschrieben war, hatte ich die Röntgenuntersuchung eines Pat. zu machen, der eine bohnergrosse, juxtapylorische Ventrikelnische hatte, umgeben von harten, wallförmigen Rändern, die auf dem Röntgenbilde auffallend wulstig schienen, weshalb die Röntgendiagnose auf *Ulcus carcinomatosum* gestellt wurde. Der Operateur war sowohl bei der Exploration in situ wie bei der makroskopischen Untersuchung des Resektionspräparates der Ansicht, dass ein einfaches kallöses Ulkus vorliege. Die histologische Diagnose war indes *Ulcus carcinomatosum*.

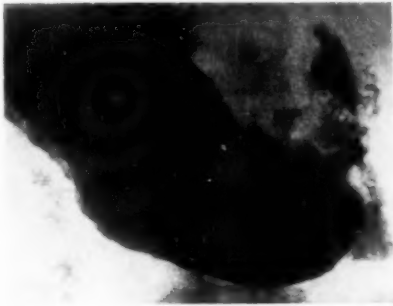


Fig. 1.

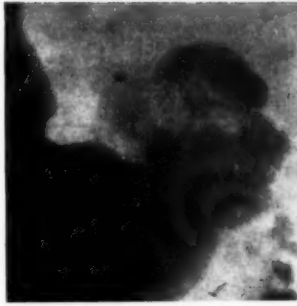


Fig. 2 a.



Fig. 2 b.



Fig. 4.



Fig. 5.



Fig. 6.



Fig. 7.



Fig. 8.

1

mitunter auf Platten, die bei direkter Kompression aufgenommen sind, deutlicher hervortreten kann — muss man in diesem Verdacht bestärkt werden. Bei unklaren Fällen darf eine baldige Kontrolluntersuchung nicht verabsäumt werden.

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Die topographischen Verhältnisse der interlobären Spalten der Lunge

von

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Die Kenntnis der Verlaufsrichtung und der Ausdehnung der interlobären Spalten der Lunge ist nicht nur für den Internisten und den Röntgenologen, sondern auch für den Chirurgen von grösster Wichtigkeit. Die letzten Jahre haben eine ganze Reihe ausgezeichneten Arbeiten über interlobäre Erkrankungen gebracht, allen voran die Arbeit von CLAIRMONT,¹ die sich sowohl auf die vom Autor selbst beobachteten Fälle stützt, als auch unter eingehender Würdigung der Literatur bis 1919 in ausführlicher Weise Aetiologie, Anatomie, pathologische Anatomie, Röntgendiagnose, klinische Diagnose, Operation behandelt. So gross aber das Interesse der Internisten, der Röntgenologen und der Chirurgen für die interlobäre Pleuritis ist, wurde merkwürdigerweise anatomischerseits die Frage der Interlobärspalten recht stiefmütterlich behandelt. Die anatomischen Angaben beziehen sich im grossen ganzen auf den Eingang der Spalten, äussere Form und Verlauf dieser »Incisurae« und ihre, gewiss wichtige, Projektion auf die Thoraxwand; wie tief aber diese Spalten einschneiden, wie sich die Umschlagstelle der Pleura interlobaris verhält, welche Form die einander zugewendeten Flächen der Lungenlappen haben, welche Verbindungen die Lappen untereinander eingehen können und manche andere, praktisch nicht minder wichtige Einzelheiten sind, man könnte fast sagen, systematisch vernachlässigt worden. DIETLEN, der sich der dankenswerten Aufgabe unterzogen hat, mittels eines Holzmodells die Projektionsverhältnisse der Interlobärspalten im Röntgenbilde zu studieren, sagt daher mit Recht: »Die genaue topische Diagnose des interlobären Exsudates steht und fällt mit der Kenntnis der Interlobärspalten im Röntgenbilde. Diese Grundfrage kehrt in allen Publikationen wieder, aber wie sich die Spalten projizieren müssen oder können, ist kaum untersucht«. DIETLEN hat sich durch seine vorbildlichen Untersuchungen

¹ Die interlobäre Pleuritis. Arch. f. klin. Chirurgie Band 114, 1919. Dasselbst Litteratur.

ein grosses Verdienst erworben und hat manchen in der Literatur beschriebenen Fall richtig umgedeutet, allein der von DIETLEN richtig eingeschlagene Weg ist nicht weiter verfolgt worden, dazu bedurfte es eingehender anatomischer Untersuchungen. Was in der Anatomie über die Interlobärspalten bekannt ist, spiegelt sich am besten in der vielleicht ausführlichsten Schilderung von WALDEYER-JÖSSEL wieder:

»Die *Incisura interlobaris sinistra*, welche die Lunge in einen Ober- und einen Unterlappen teilt, beginnt 6—8 cm unterhalb der Lungenspitze, dicht ober und hinter dem Hilus. Sie verläuft eine kurze Strecke weit aufsteigend nach hinten oben, dann absteigend über die äussere konvexe Lungenfläche nach vorne und unten, trifft den unteren, äusseren Lungenrand einen Daumen breit von seinem vorderen Ende entfernt und kehrt auf der medialen Fläche zum unteren Rand des Hilus zurück. Projiziert man die linke Inzisur, soweit sie die kostale Fläche der Lunge durchfurcht, auf die Brustwand, so beginnt die Projektionslinie im Niveau des medialen Endes der *Spina scapulae*, bezw. in der Höhe des *Proc. spinosus* des III. Brustwirbels bei horizontaler Stellung der *Clavicula* und verläuft schief absteigend über die subspinale Fläche der *Scapula* bis zum lateralen Ende des 6. Rippenknorpels. An der rechten Lunge beginnt die *Inz. interlob.* in derselben Höhe an der medialen Seite der Lunge dicht oberhalb des Hilus wie links, verläuft aber in schwächer konvexen Bogen von der medialen zur kostalen Fläche und dann zum unteren, äusseren Lungenrand, welche sie mehr als handbreit von dessen vorderem und unterem Ende trifft. Sie wendet sich dann über die Basis und über die mediale Fläche gleichfalls zum unteren Ende des Hilus. Von der *Inzis. interl. dextra* geht etwas unterhalb des höchsten Punktes von der kostalen Lungenfläche eine zweite Inzisur ab, welche fast horizontal und medialwärts zum vorderen Lungenrand verläuft und sich dann auf der medialen Fläche zum Hilus begibt. Durch diese Inzisur wird in dem oberen Lappen ein unteres, vorderes Stück, der mittlere Lappen, abgegrenzt, so dass die Lunge nunmehr 3 Lappen zählt.

Die erste Inzisur der rechten kostalen Lungenfläche trifft, auf die Thoraxwand projiziert, hinten das mediale Ende der *Spina scapulae*, zieht schräg abwärts, schneidet die hintere Axillarlinie am unteren Ende der *Scapula* und erreicht in der Mailliarlinie den unteren Lungenrand. Zieht man vom Schnittpunkte der eben beschriebenen Projektionslinie mit der hinteren Axillarlinie eine Horizontale zum Sternum, welche dasselbe am oberen sternalen Ende des 4. Interkostalraumes trifft, so ist dies die Projektionslinie der zweiten Inzisur der rechten Lunge. Die *Inzisureae interlob.* zeigen ziemlich häufig Varietäten. Durch Vermehrung ihrer Zahl wird die rechte Lunge manchmal in 4, die linke in 3 Lappen geteilt. Zuweilen ist die Vermehrung der Lungenlappen dadurch angedeutet, dass Inzisuren auf eine kleine Strecke hin vom vorderen Rand aus in die Lungensubstanz eindringen».

Um zu einer klaren Vorstellung über die Einzelheiten der Interlobärspalten zu gelangen, mussten wir eigene Untersuchungen anstellen. Diese Untersuchungen wurden im I. anatom. Institute in Wien vorgenommen und es sei uns an dieser Stelle gestattet, dem Vorstände des Institutes Herrn Professor TANDLER für die Überlassung des Materiales sowie für seine freundliche Unterstützung Dank zu sagen.

Als Untersuchungsobjekte benutzten wir hauptsächlich kindliche Lungen, und zwar aus dem Grunde, weil bei Neugeborenen und auch in den

ersten Lebensjahren sich am sichersten die normalen Verhältnisse finden; wir haben aber auch zur Kontrolle der an kindlichen Lungen ermittelten Tatsachen möglichst adhäsionsfreie Lungen Erwachsener benützt. Die Lungen waren fast durchwegs durch Injektion des ganzen Kadavers mit Formalin in situ gehärtet, erst im Körper topographisch beobachtet und nach Herausnahme morphologisch beschrieben. Wir haben über 40 Lungen auf diese Weise untersucht.

Was die grob anatomischen Verhältnisse und die Nomenklatur be-



Fig. 1.

trifft, wäre Folgendes kurz wieder in Erinnerung zu bringen:

Jeder Lungenflügel wird durch eine in der Höhe der Spina scap. beginnende nach vorne unten steil absteigende tiefe Spalte in 2 Teile zerlegt. Dadurch, dass diese bilaterale Spalte die basale Fläche der Lunge schneidet, wird eine Trennung der Lunge in einen Vorder- und Hinterlappen bewirkt. Diese Bezeichnung ist unserer Ansicht nach viel mehr gerechtfertigt als die bisher gebrauchte Nomenklatur: Oberlappen und Unterlappen, da ja die Lappen nicht übereinander

geschichtet sind, sondern sich bis auf die oberste und eine untere laterale Partie decken (Fig. 1).

Die basale Lungenfläche wird nur in dem kleineren, medio-anterioren Teil vom Vorderlappen, im ganzen übrigen Anteile vom Hinterlappen gebildet (Fig. 12). Rechts wird der Vorderlappen durch die Nebenspalte in einen oberen und einen unteren Anteil getrennt, für welche wir die Bezeichnung Ober- und Mittellappen beibehalten.

Um nicht missverstanden zu werden: *Wir unterscheiden rechts wie links einen Vorder- und Hinterlappen, der rechte Vorderlappen zerfällt aber in 2 Teile, in den Oberlappen und in den Mittellappen.*

Die äussere Oberfläche der Lunge wird von der Pleura visceralis überzogen, die sich in die Interlobärspalten einsenkt und als Ueberzug der Lappen die *Pleura interlobaris* bildet. Wir unterscheiden beiderseits eine Hauptspalte, *Fissura interlobaris princeps*, rechts aber noch eine Nebenspalte, die wir als *Fissura interlobaris media*, als Mittelspalte bezeichnen; durch die Einmündung dieser Nebenspalte in die Hauptspalte wird aber rechts die Hauptspalte noch in 2 Teile gesondert, in die

Fissura interlob. superior, zwischen Oberlappen und Hinterlappen und die *Fissura interl. infer.* zwischen Mittellappen und Hinterlappen, während die *Fissura interl. media* sich zwischen Oberlappen und Mittellappen befindet.

Diese bisher in der Anatomie fehlende Einteilung entspricht einem durchaus praktischen Bedürfnis und dürfte künftighin die Verständigung, welche Pleura interlobaris erkrankt ist, wesentlich erleichtern. Bisher half man sich mit Umschreibungen, resp. Beschreibungen des Sitzes; nach der vorgeschlagenen Nomenklatur ist ohne weiteres verständlich, wo eine Pleuritis interl. sup., eine Pleuritis interl. media, wo die Pleuritis interl. inferior sitzt. Auch links wäre trotz fehlender Nebenspalte eine Einteilung in Pleura interl. superior und inferior mit Rücksicht auf das praktische Bedürfnis nicht ganz ungerechtfertigt. Noch eine neue Bezeichnung erscheint uns wichtig. Man spricht von Pleuritis interlobaris; eine gegensätzliche Bezeichnung für eine Erkrankung, die sich im Cavum pleurae abspielt, fehlt aber, so dass man von Pleuritis schlechtweg oder von »allgemeiner« Pleuritis spricht; wir würden die Bezeichnung *Pleura peripulmonalis* im Gegensatz zur *Pleura interl.* vorschlagen, dementsprechend *Pleuritis peripulmonalis* im Gegensatz zur *Pleuritis interlobaris*. Nach diesen Vorbemerkungen wollen wir zur Beschreibung der Interlobärspalten übergehen und mit der Pleura interl. media beginnen, da die Pleuritis interl. media am häufigsten beobachtet oder zum mindesten am häufigsten diagnostiziert wird und wiederholt Gegenstand eingehender Untersuchungen war.

I. Pleura interlobaris media (dextra)

Der *Spalteneingang* beginnt knapp hinter der mittleren Axillarlinie als Abzweigung der Hauptinzisur und reicht mehr oder minder weit nach vorne und kerbt (Fig. 2) in manchen Fällen den vorderen Lungenrand. Wir bezeichnen als Spalteneingang die an der Oberfläche der Lunge deutlich sichtbare Trennungslinie der Lappen und reservieren für diese Linie die eingebürgerte Bezeichnung Inzisur, während wir die ganze Spalte als *Fissur* bezeichnen; diese Sonderung der Begriffe erscheint uns wichtig, da die Anatomie bisher ihr Hauptaugenmerk der Inzisur und nicht der ganzen Spalte zugewendet hat.

Die *Form der Inzisura media* ist im allgemeinen die eines liegenden S mit einer wechselnd starken unteren Konkavität am lateralen Beginn und mit einer unteren Konvexität am medialen Ende, welch letzterer Teil jedoch häufig nicht sichtbar ist, da Ober- und Mittellappen miteinander Verbindungen eingehen, wie noch später erörtert werden wird (Fig. 3).

Von den untersuchten 32 für die Bestimmung der Pleura interlob. media geeigneten Lungen war allerdings in 4 Fällen diese S Form durch eine einfach nach unten konvexe Linie ersetzt. Es handelte sich durch-

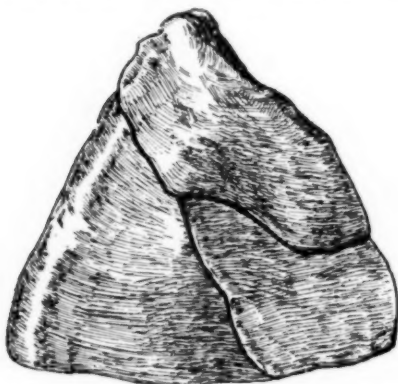


Fig. 2.

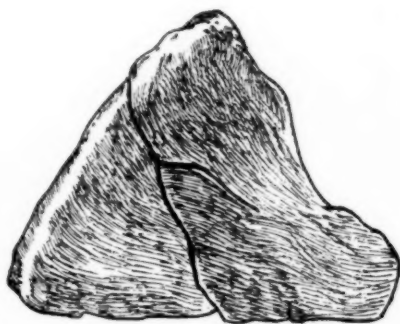


Fig. 3.

wegs um kurze, in dorsoventraler Richtung breite Lungen (Fig. 4); doch stellte sich schon nach geringer Sagittalkompression sofort die S Form automatisch wieder her. Mag vielleicht in unseren Fällen diese Erscheinung

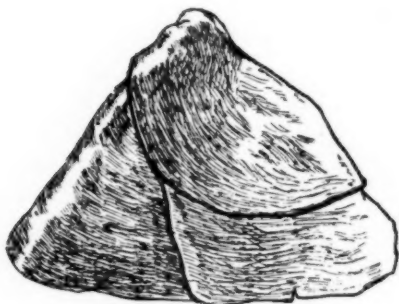


Fig. 4.

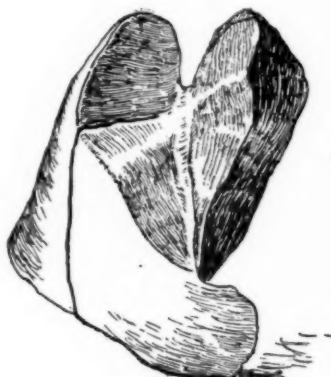


Fig. 5.

auf einem Kunstprodukt durch Härtung beruhen — Empordrängung des Zwerchfells durch postmortalen Meteorismus u. a. — so möchten wir doch den Hinweis auf eventuelle derartige Vorkommnisse beim Lebenden nicht unterlassen.

Die S Form kann derart schwach ausgeprägt sein, dass die Linie

den Eindruck einer Geraden macht, wenn man von der durch die Thoraxkrümmung bedingten kostalen Konvexität der Lunge absieht. Die kostale Konvexität entspricht einem kleineren Radius als die S Krümmung, kann daher bei der Röntgendurchleuchtung oder Aufnahme stärker als die S Form ins Gewicht fallen. So hat DIETLEN bei der Durchleuchtung seines Holzmodells, welches die S förmige Krümmung nicht enthält, gleichwohl je nach der Röhrenstellung eine unten konkave, annähernd gerade (schwach konkave) oder konvexe Begrenzung bekommen. Nun kommt aber ausser der Thoraxkrümmung auch noch die Eigenform der mittleren Inzisur in Betracht. Reicht der Spalteneingang medialwärts bis zum vorderen Lungenrand, ist also der abwärts konvexe Teil durchgängig und gut ausgebildet, dann muss die untere Begrenzungslinie in den gangbaren Projektionsrichtungen konvex bleiben. Der laterale konkave Abschnitt fällt dabei nicht stark ins Auge (Fig. 2). Denkt man sich jedoch den medialsten Abschnitt dieser Zeichnung weg, dann erscheint wieder die unten konkave Linie.

Auf dorsoventralen Röntgenbildern muss diese Linie am schärsten hervortreten, da sie der Platte am nächsten gelegen ist.

Die anatomischen Angaben über den horizontalen Verlauf der Spalte sind insoferne richtig zu stellen, als sich fast durchwegs eine Abwärtsneigung von variabler Stärke nach vorne bemerkbar macht. Nur in 4 Fällen von 32 war das mediale Ende höher gelegen als der laterale Beginn. Drei davon sind dieselben Fälle, bei denen wir oben den nach abwärts konvexen Verlauf der ganzen Inzisur beschrieben haben. Bei Sagittalkompression stellt sich nicht nur die S Form wieder her, sondern auch die normale absteigende Richtung.

Form der mittleren Interlobärspalte. Klappt man zum Studium der Ausdehnung und Form der Spalte die Lungenlappen, welche den Interlobärspalt begrenzen, auseinander, so findet man konstant bei allen Lungen eine dreieckige Fläche (sowohl am Oberlappen als auch am Mittellappen), deren Scheitel (spitzer Winkel) der Thoraxvorderfläche zugekehrt ist, deren lateralen Schenkel die S Linie, deren medialen Schenkel die Pleuraumschlagstelle und deren Basis die Schnittlinie zwischen Haupt- und Mittelfissur bildet, entsprechend jener Linie, wo die Pleura interl. media in die Pleura interl. superior und inferior übergeht (Fig. 5).

Diese Fläche steht nun, wie DIETLEN ganz richtig hervorhebt, nicht rein horizontal, sondern sie weist nach unseren Beobachtungen einen Abfall nach 2 Richtungen auf: 1 von der Basis zum Scheitel, i. e. auf die Einstellung im Körper bezogen von dorsal oben nach ventral unten und 2. einen Abfall von medial nach lateral. Die Fläche ist also schief eingestellt und zwar in der Weise, dass der mediale Punkt der Grund-

linie des Dreieckes (Punkt A) zugleich der höchste ist, während der Scheitel des Dreieckes (Punkt B) den tiefsten Punkt bildet, wobei aber der mediale Schenkel des Dreieckes (Pleuraumschlagsstelle) höher liegt als der laterale Schenkel, welcher der S förmigen Linie (Inzisur) entspricht. Die Grösse der Neigung anzugeben hätte keinen besonderen Zweck, da sie zu sehr variiert, es wäre nur zu bemerken, dass im allgemeinen der Sagittalabfall geringer ist als der Lateralabfall, welcher zwischen 10 und 30 Grad schwankt. Eine klinische Erscheinung, die dem Praktiker wohl bekannt ist, ist durch dieses Verhalten erklärt: die Verschieblichkeit der Empyeme beim Stehen nach vorne und lateral.

Wäre nun die Spaltenfläche eine veritable Ebene, d. h. abgesehen von der schiefen Einstellung im Raume gänzlich plan, dann müsste sich ein im Interlobärspace ausbreitender Erguss bei der Durchleuchtung bei einem bestimmten Strahlengang strich- oder bandförmig projizieren, was aber nicht oder nicht vollkommen zutrifft; meistens erscheint der Schatten an der einen oder anderen Stelle breiter.

Die anatomische Untersuchung lehrt, dass die Spalte nach den gleichen Richtungen gewölbt ist, nach welchen der Abfall stattfindet und zwar sieht die Konvexität nach oben (kranialwärts), wobei die Krümmung im Sagittaldurchmesser eine stärkere ist als im Transversaldurchmesser. Von der ebenfalls variablen Stärke dieser Wölbung, hauptsächlich der sagittalen, hängt das Kleinerwerden, resp. die linienförmige Projektion bei entsprechend hoher Einstellung der Röntgenröhre ab, indem stark gewölbte Spalten weniger gut zu einem Strich reduziert werden können. Allerdings können auch massige interlobäre Ergüsse diese Wölbungen modifizieren, ja es kann der Erguss durch Auseinanderdrängen der Lappen Kugelform annehmen. (s. CLAIRMONT). Diese kranial gerichtete Wölbung ist in der überwiegenden Mehrzahl der untersuchten Fälle (22) zu finden; als Varietät wollen wir anführen, dass dort, wo die Inzisur weit nach vorne, medial reicht, sich sogar eine Art Mulde ausbilden kann, so dass wir gewissermassen hinten eine hügelige, vorne eine muldenförmige Fläche vor uns haben und die für die Inzisur charakteristische Form (S) auch im Inneren der Spalte finden (3 Fälle). Bei 2 Lungen, welche gleichzeitig eine aufsteigende und im ganzen Verlaufe eine nach abwärts konvexe Inzisur aufwiesen (Fig 4), war die obere Grenzfläche des Mittellappens in toto muldenförmig.

Begrenzungslinien der Spalte

1. Die laterale Begrenzung entspricht der bereits beschriebenen Inzisur, der S Linie.
2. Die *hintere* Begrenzungslinie verbindet den Schnittpunkt zwischen

Haupt- und Mittelliniszur (Punkt C, der am meisten nach rückwärts, hinter der mittleren Axillarlinie gelegene Punkt der S Linie) mit dem medial gelegenen, hilusnahen Punkte A. Da der Hilus näher dem hinteren Lungenrande liegt, ist damit auch schon der Verlauf dieser Linie gegeben: sie muss annähernd frontal verlaufen mit geringer Abweichung nach links hinten, wie dies aus dem schematischen Transversalschnitt (Fig. 6) ersichtlich ist.

Ausser dieser beiläufigen Frontaleinstellung kommt natürlich noch ein Lateralabfall gegen C zu in Betracht, genau entsprechend dem oben beschriebenen Abfall der Spaltenfläche (Fig. 5), so dass also diese Linie hinter

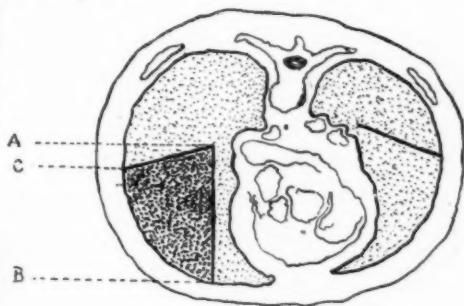


Fig. 6.

der mittleren Axillarlinie beginnt und nach medial hinten oben ansteigt. Was die Projektion dieser Linie anlangt, so eignet sich hiezu am besten eine Einstellung der Röhre rechts hinten, so dass die Strahlen von rechts hinten nach links vorne verlaufen. Bei dorsoventraler Durchleuchtung und entsprechender Einstellung ist sie als ziemlich lange Linie sichtbar, die obere Begrenzung eines dreieckigen Schattens bildend. Ihre Begrenzung ist, da sie die plattenfernste Partie bildet, im Röntgenbilde eine unscharfe. Was die Länge dieser Linie anlangt, so reicht sie in den meisten Fällen nicht ganz soweit medialwärts wie die Mittelspalte. Gewöhnlich sehen wir, dass Mittel- und Hinterlappen durch eine kleine Substanzbrücke am Grunde der Spalte verwachsen sind, oft aber eine kleine Pleuraduplikatur den innersten Teil der Spalte verschliesst, Vorkommnisse, welche für die Ausbreitung von Ergüssen von Bedeutung sein können (Fig. 7). Statistisch ergibt sich von 36 untersuchten Fällen folgendes Resultat: In 9 Fällen dringt der untere Teil der Hauptinzisur genau bis zur Tiefe der Mittelspalte ein, so dass am Punkte A (Hilusnähe!) alle 3 Spalten gleich tief waren. In 6 Fällen besteht eine partielle Verschmelzung zwischen Ober- und Mittellappen, so dass die Mittelspalte seichter war. In 21 Fällen hingen Mittel- und Hinterlappen auf eine der erwähnten Arten zusammen, also entweder durch eine Parenchymbrücke oder eine Pleuraduplikatur. Daher wohl auch die Ausbreitung kombinierter, interlobärer Ergüsse in diesen Fällen ihren natürlichen Weg von der Pleura interl. superior zur Pleura interl. media und nicht zur inferior nehmen müsste.

3. Die Umschlagstelle der Pleura interl. vom Oberlappen zum Mittel-

lappen ist die variabelste Linie und stellt gleichzeitig die mediale Begrenzung des Dreieckes dar. Von der Stelle ihrer Etablierung hängt auch die Tiefe der Spalte ab.

Im allgemeinen lässt sich sagen, dass ihr Verlauf entsprechend der

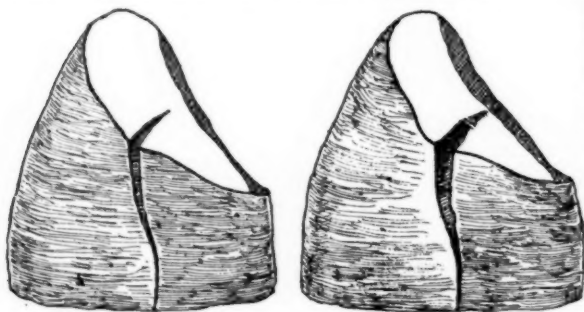


Fig. 7.

Flächenwölbung der Spalte meisteiner nach unten und lateral konvexen Linie entspricht, die an der Hauptinzisur beginnt und gegen die vordere Lungenfläche verläuft. Betrachteten wir einen Thorax von oben und entfernen wir den Oberlappen, so ergibt sich ein Bild, wie es

in Fig. 8 dargestellt ist. Wir erkennen eine Dreiteilung der vor uns liegenden Lungenfläche und zwar dorsal ein Stück des Hinterlappens, ferner die dreieckige Oberfläche des Mittellappens und weiters die Zusammenhangsstelle der 3 Lappen untereinander (schraffiert). Die Umschlagstelle der Pleura interl. media ist deutlich sichtbar.

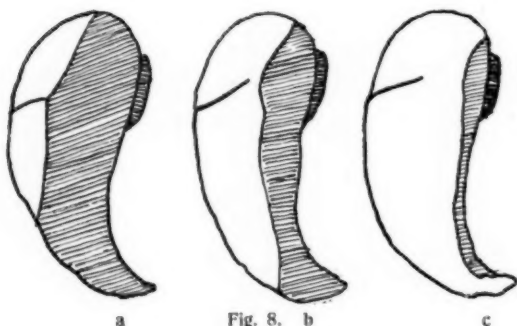


Fig. 8. b

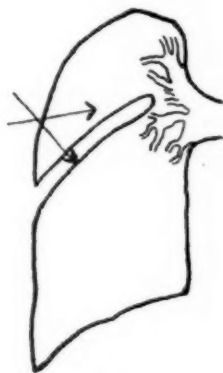


Fig. 9.

In bezug auf das medial gelegene Verwachsungsfeld finden wir sehr grosse Verschiedenheiten. Neben Fällen, wo fast vollständige Verschmelzung des Ober- und Mittellappens vorliegt, findet man oft Fälle, wo das Verwachsungsfeld am Hinterlappen beginnt und streifenförmig nach vorne zieht, so dass nur der medialste Teil des Spalteneinganges obliteriert ist (Fig. 8 b).

In extremen Fällen finden wir hingegen, dass die Zusammenhangsfläche die vordere Lungenfläche nicht erreicht, so dass hier die Inzisura interl. media den vorderen Lungenrand kerbt (Fig. 8 c). Der Abschluss der Mittelspalte medialwärts ist also konstant ein mehr oder minder guter, entsprechend dem sagittalen Verlaufe der Pleuraumschlagstelle und der Annäherung an den vorderen Lungenrand. Ueber die Häufigkeit der Verwachsungen gibt folgende Tabelle Aufschluss:

Parenchymatöse Verwachsung des vorderen (mediastinalen) Lungenrandes	18
Pleurale	7
Durchschneiden der Mittelspalte durch den vorderen Lungenrand	12

Konstant ist ferner die Verlaufsrichtung der Pleuraumschlagstelle, die wir an den nebenstehenden Aufsichten oder noch besser am schematisierten Transversalschnitt der Fig. 6 überblicken können. Sie ist eine sagittale und zeigt nur selten ganz geringfügige Abweichungen. Starke Verwachsungen der beiden Anteile des Vorderlappens beeinflussen die *Richtung* der Linie A B nicht, wie aus Fig. 8 hervorgeht. Durch grössere Ausdehnung des Verwachsungsfeldes wird diese Linie nur lateralwärts verschoben, ohne dass die sagittale Orientierung verloren ginge. *Es wird also das Spaltendreieck kleiner, ohne dass die Begrenzungslinien ihre Verlaufsrichtung aufgeben.*

Dies ist aber für den Röntgenologen von grösster Wichtigkeit, insofern als ihm trotz grosser Variabilität der Spaltentiefe durch regelmässig wiederkehrende Schattenumrisse einigermaßen ein Mittel an die Hand gegeben ist, sichtbare pathologische Veränderungen der Pleura interlob. media gegen Erkrankungen der Lunge selbst zu differenzieren.

Untersuchen wir die Projektionsverhältnisse der Linie AB am Transversalschnitt Fig. 6. bei der Durchleuchtung in dorsoventraler Richtung, so müssen Punkt A und Punkt B in derselben Entfernung von der Medianebene erscheinen, wenn sich das Zentrum der Röhre in einer Ebene mit der Pleuraumschlagstelle befindet. Es werden aber bei entsprechender Einstellung der Röhre die beiden Punkte so gegeneinander projiziert, dass der eine unterhalb des anderen zu liegen kommt, entsprechend dem Sagittalabfall der Spalte, wodurch Punkt A höher liegt als Punkt B. Es muss sich daher die Pleuraumschlagstelle als vertikaler Abschluss des allenfalls vorhandenen Schattens der Pleura interl. media präsentieren. Nur bei entsprechend hoher Einstellung der Röhre können beide Punkte zur Deckung gebracht werden, wie dies Dietlen richtig angibt.

Die Höhe dieser medialen Schattengrenze ist selbstverständlich variabel und hängt nicht von der Länge der Linie AB ab, sondern von der Höhendifferenz, also dem mehr oder minder steilen Abfall der Spalte nach vorne, nur bei entsprechender Tiefstellung der Röhre kann sie in normaler Grösse (bei orthodiagraphischer Bestimmung und Einstellung des Zentralstrahles senkrecht auf die Spaltenebene) oder vergrössert erscheinen. Die Auffassung, dass die Verbreiterung des Schattens medialwärts durch den interlobären Erguss bedingt sei, der hier in grösserem Masse vorhanden sein könnte, ist also irrig, dies umso mehr, als die Möglichkeit der

Erweiterung des Spaltes im Sinne des Auseinanderdrängens der Lappen gerade medial am geringsten ist, da sich ja eben hier die besprochenen Verwachsungen zwischen den Lappen vorfinden. Auch die Angaben der Literatur, der Schatten werde medial am dichtesten, ist auf die längs dieser Linie sehr tiefe Fläche zurückzuführen, denn längs der Pleuraumschlagsstelle muss naturgemäss die durchstrahlte Partie ihre grösste Ausdehnung haben.

Innig verknüpft mit der Frage nach dem Orte der Etablierung dieser Linie ist auch die Frage nach der Spaltentiefe, i. e. nach der Ausdehnung von Verwachsung zwischen Ober- und Mittellappen, welche praktisch von grosser Wichtigkeit sein kann, denn reicht die Spalte nur wenig nach vorne und medialwärts, dann kann ein interlobäres Empyem als abgesacktes, lateral wandständiges, peripulmonales Empyem imponieren.

Bei der Durchsicht einer grösseren Anzahl von Präparaten kann man nicht konstatieren, dass es Lungen mit starken Verwachsungen in allen Fissuren und seichten Interlobärspalten gibt, anderseits Lungen mit tiefen, resp. gänzlich durchschneidenden Inzisuren, wenngleich starke Verschmelzung im Bereiche der einen Spalte auch häufig mit Obliteration der anderen Spalten kombiniert ist. Doch ist dieses Verhalten nicht ausnahmslos die Regel.

Die mehr oder minder tiefe Einsenkung der Pleura interlobaris geht schon ante partum vor sich und scheint vom Stadium des Neugeborenen an während des ganzen Lebens in denselben Relationen bestehen zu bleiben, abgesehen von späteren pathologischen Adhäsionen. Wenigstens zeigt sich kein auffallender Unterschied in der Statistik der Spaltentiefe zwischen kindlichen und erwachsenen Lungen.

Was die *Tiefe* der Spalte anlangt, sei daran erinnert, dass sich die Mittelspalte von lateral her gegen die Mediastinalfläche der Lunge zu einsenkt. Die Variabilität der Einsenkungsgrösse ist aus Fig. 8 ersichtlich.

Beziehung zum Hilus. Durch Lage und Verlauf tritt die Mittelspalte in wichtige topographische Beziehungen zum Hilus, die für die Pathogenese und die Diagnostik interlobärer Prozesse nicht ohne Belang erscheinen.

Für die Praxis von Interesse ist die Feststellung, dass der höchste Punkt der Mittelspalte, Punkt A, in der Höhe des Hiluszentrums gelegen ist, während der tiefstgelegene Punkt, Punkt B, die durch den unteren Rand des Hilus gelegte Horizontalebene erreicht. Nur in 4 von 37 Fällen (durchwegs stark verwachsene Mittelspalten betreffend) lag die Spalte mehr nach abwärts, am unteren Hilusrand beginnend, eine Feststellung, die wichtig ist, da in der Literatur die Mittelspalte ziemlich übereinstimmend in die Höhe des Sternalansatzes der 3—4. Rippe verlegt wird, während sie Rochard zuweilen in der Höhe des 5. Rippenansatzes fand, was der eben gemachten Angabe entsprechen dürfte.

Es ergibt sich daraus die praktische Folgerung, dass bei Darstellung der Mittelspalte im Röntgenbilde die Einstellung der Röhre in Hilushöhe

gewählt werden muss, ferner, dass bei richtiger Einstellung die mediale Schattengrenze in den Bereich der unteren Hilushälfte fallen muss.

Da der Eckpunkt A nicht allein in vertikaler Richtung in der Hilusmitte liegt, sondern auch im Horizontalschnitte der Ebene des Hiluszentrums entspricht und sich so dem Hilusmittelpunkte nähert, wollen wir ihn als *den hilusnahen Punkt* bezeichnen.

Zu untersuchen ist nun die Entfernung dieser beiden Stellen voneinander. Bei den diesbezüglichen Messungen ergab sich nun die Schwierigkeit, das Hiluszentrum zu fixieren. Wir haben nach Durchschneidung der ganzen Lungenwurzel in der Ebene der mediastinalen Lungenfläche den Mittelpunkt des zurückbleibenden Ovals als Hiluszentrum angenommen. Das Hilusoval, dessen Längsachse vertikal gestellt ist, liegt in der Richtung von vorne nach rückwärts dem hinteren, stumpfen Lungenrand näher, und wenn wir die Breite der mediastinalen Lungenfläche in 4 Teile teilen, nimmt der schmalere horizontale Durchmesser $\frac{1}{4}$ der mediastinalen Lungenfläche ein, seine rückwärtige Begrenzung ist $\frac{1}{4}$ vom hinteren Lungenrand entfernt, seine vordere $\frac{1}{2}$ vom vorderen, scharfen Lungenrand; der Längsdurchmesser nimmt ungefähr die Hälfte der Länge der mediastinalen Fläche ein, die Distanz zwischen unterer Begrenzung des Ovals vom unteren Lungenrand ist kleiner als die Distanz der oberen Begrenzung von der Lungenspitze.

Die Statistik ergibt nun folgende Resultate:

Die Spalten-Hilusdistanz beträgt:

in 3 4 9 15 2 4 Fällen

zirka $0 \frac{1}{6} \frac{1}{3} \frac{1}{2} \frac{2}{3} \frac{5}{6}$ der Entfernung zwischen Hiluszentrum und der lateralen Lungenfläche, d. h. nehmen wir die Distanz zwischen Hilusmitte und lateraler Kontur der Lunge — ungefähr der mittlerern Axillarlinie entsprechend — als Einheit, so fällt in 3 Fällen der hilusnahe Punkt mit der Hilusmitte selbst zusammen und beträgt in den extremen 4 Fällen $\frac{5}{6}$ der Hilus-Lateralidistanz, ist also von der lateralen Lungenkontur bloss $\frac{1}{6}$ der Hilus-Lateralidistanz entfernt. Mit anderen Worten: ein Erguss in der Mittelspalte kann bis in den Bereich der Hilusmitte reichen, er kann aber in extremen Fällen von der mediastinalen Lungenfläche soweit entfernt sein, dass es schwierig sein kann, den Erguss als in der Mittelspalte gelegen zu agnoszieren, worauf schon oben aufmerksam gemacht wurde. Anatomisch lassen sich mithin keine absoluten Regelmässigkeiten in dieser Beziehung feststellen. Nach obiger Tabelle liegt der hilusnahe Punkt meist $\frac{1}{3}$ — $\frac{2}{3}$ der Lungenbreite von der mediastinalen Fläche entfernt. Doch gibt uns dieses Verhältnis nur einen annähernden Überblick über die Lage von A, nicht aber über seine wirkliche Beziehung zu den am Hilus eintretenden Gebilden. Denn diese gabeln sich gleich nach ihrem Eintritt in die mediale Lungenfläche in die einzelnen

Lappen versorgenden Zweige (s. Fig. 9). Das Areale, das von diesen grösseren, am Röntgenbilde noch sichtbaren Hilusgebilden eingenommen wird, dringt ungefähr $\frac{1}{6}$ der Lungenbreite

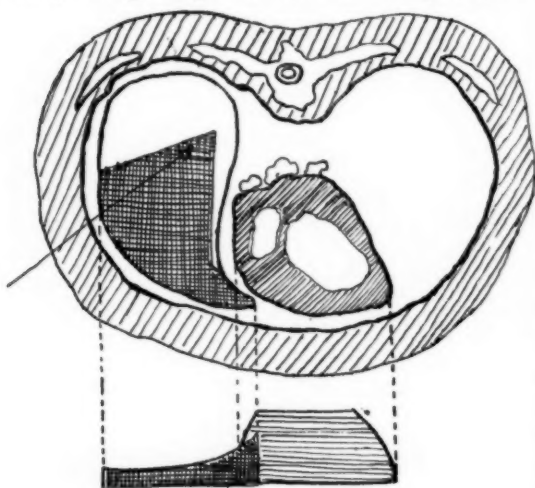


Fig. 10.

lateralwärts vor. Daraus der Schluss: Dringt die Spalte $\frac{5}{6}$ der Lungenbreite oder noch tiefer medialwärts vor, so stehen Spalte und Hilusschatten in direkter Kontinuität (in circa 25 % der Fälle). Die wechselnden Angaben der einzelnen Autoren hierüber sind also nicht auf Beobachtungsfehler, sondern einfach auf die wechselnde Tiefe der Spalte und mithin auf die wechselnde Tiefe des interlobären Ergusses zurückzuführen. Die horizontale Länge des im Röntgenbilde erscheinenden Schattenbandes hängt mit-

hin von der Spaltentiefe ab, vorausgesetzt, dass ein Erguss nicht im Spalt selbst wieder abgesackt ist.

Im Zusammenhange mit dem Gesagten soll auch noch die Abgrenzung gegen den Herzschatten erwähnt werden, worüber ebenfalls divergierende Angaben der verschiedenen Autoren vorliegen. Eine zwischen beiden Schatten befindliche lufthältige Zone deutet uns eine seichte Spalte an, während das Zusammenfließen der Erguss-Herzgrenze eine weit offene, durchschneidende Spalte kennzeichnet (Fig. 10).

Die Häufigkeit von Parenchym- und Pleurabrücken zwischen Lobus medius und den anderen Lappen wurde bereits hervorgehoben.

Zusammenhang zwischen Mittel- und Oberlappen in 6 Fällen,

» » » » Hinterlappen » 21 »

Sämtliche Lappen stossen in einem Punkte zusammen 9 Fälle.

Irgendwelche Zusammenhänge zwischen Verwachsung im vorderen Anteile der Mittelspalte und den Brücken in der Tiefe am hilusnahen Punkt lassen sich nicht finden, nur bei den sehr kurz nach vorne reichenden Mittelfissuren ist immer eine stärkere Verschmelzung der beiden Anteile des Vorderlappens zu finden.

Bei allgemeiner Neigung einer Lunge zu Pleuraduplikaturen sind die Verwachsungen eben nur pleurale, d. h. die Lappen lassen sich makro-

skopisch mehr minder gut ohne Parenchymverletzung trennen, allerdings meist nicht in der ganzen Ausdehnung der Spalte. Die Frage, ob Parenchymverschmelzung oder Pleuraduplikatur, kommt für den Praktiker wohl kaum in Betracht. Das Wichtigste ist wohl der regelmässige Abschluss der Mittelspalte medialwärts, wodurch ein Übergreifen eines Prozesses auf die Pleura mediastinalis durchgehends verhindert wird. Eine Kombination von interlobärer und peripulmonaler Erkrankung ist daher nur längs der Pleura costalis möglich. Diese Feststellungen sind auch für den chirurgischen Eingriff von Wichtigkeit. Während man im medialen Spaltenabschnitt Gefahr läuft in eine Parenchymbrücke zwischen Oberlappen und Mittellappen zu geraten, wird dies in der Gegend der vorderen Axillarlinie sicher vermieden. Ausserdem steht bei der Punktion der Nadel hier die grösste Tiefe des Empyems zur Verfügung, was die Wahrscheinlichkeit der Erreichung des Empyems nach Durchstechen des Oberlappens wesentlich erhöht (Fig. 10). Ausserdem wäre der Nadel eine schiefe Richtung zu geben, um nicht parallel dem Abfall der Spalte zu punktieren, sondern möglichst senkrecht zu ihrer Fläche einzustechen (Fig. 9).

Für die *Punktion* liesse sich also folgende Regel geben: Einstich in der vorderen Axillarlinie, im 3. Interkostalraum rechts, die Nadel zirca 30 Grad gegen den Horizont nach abwärts geneigt und gegen die Wirbelsäule zu einstossen.

Mechanische Ausbreitungsmöglichkeit von Ergüssen

Ergüsse, welche in der Pleura interl. superior ihren Ausgang nehmen, können ihren Weg sowohl in die Pleura interl. infer. wie in die Mittelspalte nehmen, wofür die Schnittlinie zwischen Mittel- und Hauptspalte massgebend ist. Der Mittellappen ist an der Einmündung in die Hauptinzisur wie die Schneide eines Keiles zugespitzt und schiebt sich in die Hauptinzisur wie eine Schienenweiche, kann also bald von vorne nach rückwärts, bald von rückwärts nach vorne verschoben werden, je nachdem aber die Mittelspalte oder die untere Hauptspalte in der Richtung der Fissura interl. sup. gelegen ist, kann sich der Erguss mit grösserer Leichtigkeit in die Fissura interl. infer. oder media fortsetzen.

Der Winkel, den die Schneide des Keiles bildet, kann sehr spitz sein, in diesem Falle legt sich die Schneide des Keiles direkt in eine Aushöhlung des Hinterlappens hinein. Nähert sich dieser Winkel einem rechten, dann liegen oberer und unterer Teil der Hauptspalte in einer Ebene.

Die Einpassung des Mittellappens in die Substanz des Ober- oder Hinterlappens scheint für die Richtung wandernder Empyeme fast eine

noch grössere Bedeutung zu haben als die Winkelbildung der Schneide des Mittellappens. Denn ganz ungezwungen drängt sich dem Beobachter solcher formalingehärteter Lungen der Gedanke auf, ein Erguss müsse im gegebenen Falle diesen oder jenen Weg nehmen, je nachdem die Richtung der Oberspalte sich direkt in der Richtung der Mittel- oder der Unterspalte fortsetzt.

Ein weiterer Faktor für die Ausbreitung von Ergüssen wäre noch in der Tiefe der Fissur zu suchen. Es schneidet nämlich, wie schon oben beschrieben, in sehr vielen Fällen die hintere Begrenzungslinie nicht gänzlich bis zur Pleuraumschlagstelle durch, sondern endet schon früher, indem ein Zusammenhang zwischen Mittel- und Hinterlappen besteht.

II. Pleura interlobaris princeps (Fissura interlobaris princeps)

a. Rückwärtiger (oberer) Teil

Die Hauptspalte beginnt im oberen Anteile des Hilus, steigt lateral aufwärts, um mit dem höchsten Punkte eines parabolischen Bogens über die Transversalebene des oberen Hilusrandes noch ein Stück hinaufzuragen und gegen die laterale Lungenfläche zu etwas steiler abzufallen. Die höchste Stelle entspricht dem dorsalsten Punkte der Lunge. Sehr häufig ist der medialste Abschnitt obliteriert, so dass der vom Hilus aufsteigende Teil fehlen kann oder es spannt sich eine kleine Pleuraduplikatur vom Oberlappen zum Hinterlappen.

Verhältnis der Spalte zum Hilus

links rechts

Parenchymatöse Verschmelzung zwischen Oberlappen und Hinterl.	10	16
Pleuraler Abschluss der Spalte	7	6
Offen bis zum Hilus	11	6

Es geht also aus dieser Zusammenstellung hervor, dass links in der Regel weniger starke Abschlüsse vorhanden sind, d. h., dass die Spalte näher dem Hilus endigt als rechts. Nur in 3 von 28 Fällen war das umgekehrte Verhalten der Fall.

Die Incisura interl. sinistra verläuft höher als die rechte, was durch den steileren Bogen links zum Ausdruck kommt; gleichzeitig beginnt aber auch die rechte Furche am Hilus tiefer als die linke. (Fig. 11.)

Der Oberlappen nimmt ein		links	rechts	Fällen
$\frac{1}{3}$ der Lungenhinterfläche	in	8	1	
$\frac{1}{4}$ » » » » »	»	11	3	»
weniger als $\frac{1}{3}$ » » » » »	»	5	13	»
$\frac{1}{3}$ » » » » »	»	0	6	»
mehr als $\frac{1}{3}$ » » » » »	»	0	2	»

Von der dorsalen Fläche der Lunge nimmt, wie aus dieser Zusammenstellung hervorgeht, der Oberlappen resp. Vorderlappen rechts ein grösseres Areale ein als links. Diese Verhältnisse beziehen sich auf die ganze Lungenhinterfläche. Für die Röntgenuntersuchung sind aber nicht diese Zahlen, sondern vielmehr die Kenntnis des Verhältnisses zwischen Lungenspitze und Zwerchfellkuppe von Wichtigkeit, nachdem der im Sinus phrenicocostalis befindliche Lungenanteil vom Zwerchfellschatten ventrodorsal und dorsoventral gedeckt wird. Für diese Entfernung fanden wir folgende Zahlen:

Oberlappen nimmt von der Zwerchfell-Spitzendistanz ein	links	rechts
mehr als $\frac{1}{2}$	0	0
$\frac{1}{2}$	0	8
weniger als $\frac{1}{2}$	6	11
$\frac{1}{3}$	14	5
$\frac{1}{4}$	4	1

Im Röntgenbild ist mithin die Kuppe der Hauptinzisur rechts meist in der Hälfte, links aber im oberen Drittel des Lungenbildes zu suchen.

b. Lateraler Teil

Verfolgen wir die Fortsetzung der Inzisur auf die laterale Lungenfläche so finden wir rechts die Linie fast regelmässig aus 2 konkaven Bogen bestehend, welche an der Stelle der Einmündung der Nebenzinzisur durch einen schwachen Buckel verbunden werden. (Fig. 2—4, 13). Es gibt natürlich so wie bei der Nebenspalte auch hier eine mehr oder weniger weitgehende Streckung, so dass der Grundtypus verwischt sein kann. In mehreren Fällen z. B. beobachten wir den intermediären Buckel in grösserer Ausdehnung und stark prominent, der Grundtypus bleibt aber dabei gewahrt.

Die Inzisura interlobaris princeps der linken Seite nähert sich einer Geraden, zeigt jedoch manchmal einen ähnlichen Typus wie die Inz. interl. dextra, i. e. 2 nach oben konkave Krümmungen und zwischen beiden eine konvexe Krümmung. Die Thoraxkrümmung ist an der Lateralfäche der Lunge eine sehr schwache und zwar einerseits wegen des steilen Abfalles der Inzisur nach medial vorne zu, anderseits, da die Lunge an der facies lateralis weniger stark gekrümmt ist als rückwärts am stumpfen Rande, der sich ja in die tiefe Einsenkung zwischen Wirbelsäule und Rippen legt. Bei der Durchleuchtung spielt hier, lateralwärts, die Thoraxkrümmung keine Rolle, die Eigenkrümmung der Inzisur käme aber bei seitlicher Durchleuchtung zum Vorschein.

Die den Spalteneingang bildenden Kanten der Lungenlappen zeigen fol-

gendes charakteristische Verhalten, das wir genauer besprechen wollen mit Rücksicht auf die eventuelle Möglichkeit eines Übergreifens einer interlobären Pleuritis auf den Peripulmonalraum und umgekehrt. An der rechten Hauptfissur stossen die beiden Lappen im Bereiche des oberen Teiles mit scharfen Kanten aneinander, während im letzten Drittel sich die Kante des Hinterlappens immer mehr und mehr abrundet, gleichzeitig aber sich die Kante des Mittellappens zuschärft, so dass sich im basalen Teile der Lunge der Mittellappen über den Hinterlappen schiebt (Fig. 1). An der linken Lunge ist dieses Verhalten wohl im untersten Teile angedeutet, nie aber derart charakteristisch ausgeprägt wie an der rechten Lunge, ja in 2 Fällen trat links sogar das umgekehrte Verhalten ein, dass sich nämlich der Hinterlappen über den Vorderlappen legte.

Dem Verhalten der Kanten dürfte wohl eine Bedeutung in der Ausbreitung wandständiger Ergüsse zukommen. Es kann bei peripulmonalen Ergüssen durch Anpressen der Kanten der Spalteneingang leicht abgeschlossen werden, während bei senkrechter Einmündung der Spalte ein peripulmonaler Erguss leichter den Weg in die Interlobärspalte finden würde, vorausgesetzt, dass sich der Prozess nicht auf dem Lymphwege fortsetzt.

Die Hauptfissur verläuft links steiler als rechts und zwar beträgt der Winkel links circa 60 Grad Neigung gegen die Horizontale — durch den vorderen Lungenrand gelegt — rechts circa 50 Grad. Die steilere Neigung links wird scheinbar noch dadurch vermehrt, dass die Furche höher oben beginnt, dafür aber weiter vorne, i. e. medial endet, so dass sie im ganzen weiter ventral liegt als die rechte. Bei dorsoventraler Durchleuchtung muss sich diese Furche, wenn sie zur Darstellung kommt, als eine medialwärts absteigende Linie projizieren, die links weiter medial gelegen ist und ein grösseres dreieckiges Stück des Hinterlappens als rechts zum Vorschein kommen lässt.

c. Unterer Lungenrand

Im weitem Verlaufe kerbt die Hauptfissur den unteren Lungenrand vorne, und zwar die rechte weiter lateral als die linke, die rechte zwischen vorderer Axillarlinie und Mamillarlinie. Bei der Durchleuchtung muss sich die Hauptinzisur hier als dem Schirm oder der Platte zunächst gelegen präsentieren und muss, vorausgesetzt, dass der Erguss nicht im Spalt abgesackt ist, sich im Zwerchfellschatten verlieren, wie dies *Dietlen* mit Recht hervorhebt.

d. Basale Lungenfläche

An der Basis angelangt, nimmt die Furche plötzlich einen Verlauf nach medial rückwärts, um zum medialen, unteren Lungenrande zu gelangen, den sie auch meistens kerbt. Es ist mithin der Schnittpunkt

der Linie mit dem unteren, vorderen Lungenrande der vorderste und medialste Punkt der ganzen Spalte. Die Richtung, die bisher eine medio-ventrale war, geht hier in eine zirca 45 Grad gegen die Sagittale geneigte mediodorsale über. In der Winkelbildung ist zwischen links und rechts kein Unterschied, nur entsprechend dem mehr lateralen Verlaufe der Linie rechts muss hier die Linie weiter dorsal verlaufen und so einen grösseren Keil des unteren Anteiles des Vorderlappens (Mittellappens) an der Basis sichtbar werden lassen als links (Fig. 1). Das Verhältnis der an der Basis sichtbaren Lappen stellt sich rechts — Mittellappen zu Hinterlappen — wie 1:2, 5, links — Vorderlappen zu Hinterlappen — wie 1:6. Durch den lateralen Verlauf kerbt die rechtsseitige Linie den medialen Rand schon in der Längsachse des Hilus, links jedoch erfolgt die Einkerbung noch weit ventral vom Hilus.

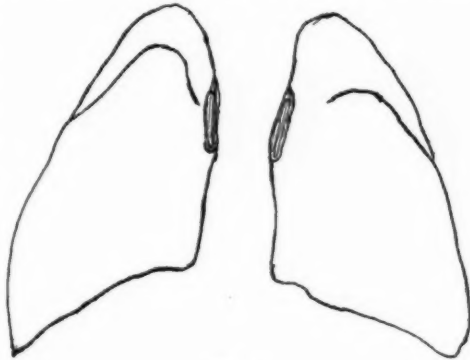


Fig. 11.

Die Kantenbildung an der basalen Fläche ist umgekehrt wie an der lateralen, d. h. wir finden auch hier wieder keine rechtwinkligen Kanten, sondern es zeigt hier der Hinterlappen eine keilförmige Schneide, an die sich die abgerundete Kante des Vorderlappens resp. Mittellappens anlegt (Fig. 1). Ein Erguss an der Pleura diaphragmatica müsste auch hier den Spalteneingang verschliessen. Es sind aber von Clairmont Fälle beschrieben, wo subphrenische Abszesse zu Ergüssen in der Hauptspalte (Pleura interl. infer.) Anlass gegeben haben. Sieht man von der Ausbreitung durch die Lymphwege ab, so wäre ein Eindringen eines Ergusses am medialen Rande möglich, wo die Kanten rechtwinklig werden. Eine andere Möglichkeit wäre die, dass der Erguss von vorne her in den Interlobärspalt eindringt, da die Spalte nach vorne zu geöffnet ist und da auch noch die Abrundung der Kante des Mittellappens unterstützend wirken könnte. Wir haben den Kanten gerade mit Rücksicht auf die Ausbreitung peripulmonaler Ergüsse auf die Interlobärspalten unser Interesse zugewendet und wenn auch unsere Erwägungen rein theoretischer Natur sind, könnten sie immerhin für künftige Forschungen von Bedeutung sein.

e. Mediale Fläche

An der medialen Lungenfläche setzt die Furche ihren nach rückwärts gerichteten Verlauf fort und zwar die linke entsprechend ihrer mehr ster-

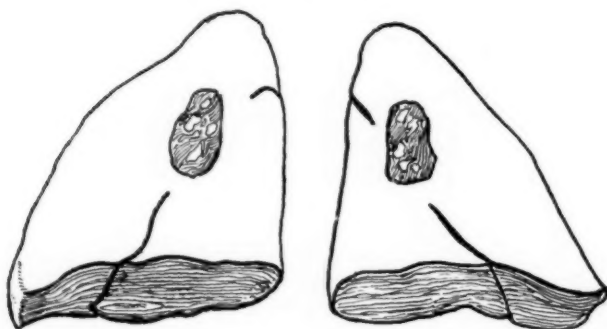


Fig. 12.

nalnalen Lage, weniger steil, die rechte dagegen steiler (Fig. 12). Dieser Furchenteil zeigt jedoch meist mehr oder weniger weitgehende Verwachsungen in Form von Parenchymbrücken oder Pleuraduplikaturen, welche, vom Hilus nach

abwärts reichend, oft sogar die basale Lungenfläche erreichen, so dass die Furche schon an der Lungenbasis ihren Abschluss findet. Folgende Zahlen geben Aufschluss über die verschiedenen Arten von Verwachsungen:

Art der Verwachsung	links	rechts
Parenchymatöse an der Basalfläche	5	2
» am unteren Rand	2	5
» an der medialen Fläche	7	9
pleurale an der medialen Fläche	10	9
offen bis zum Hilus	4	3

Die Kanten sind stumpfer als an der Basis, wenn sich die Tendenz des Übereinanderlegens auch hier geltend macht. Vorderlappen, resp. Mittellappen bilden den spitzen Winkel, Hinterlappen den stumpfen.

f. Mediale Begrenzung, i. e. Pleuraumschlagstelle

Klappt man die Hauptspalte auf, dann übersieht man die ganze innere Oberfläche und gleichzeitig den noch nicht beschriebenen, restlichen Teil der medialen Abgrenzung, i. e. die Pleuraumschlagstelle vom Vorderlappen zum Hinterlappen. Während wir in der linken Lunge ganz klare, konstante Verhältnisse finden, gestaltet sich an der rechten Lunge das Verhalten dieser Linie durch Einmündung der Nebenspalte wesentlich komplizierter.

Die Linie beginnt entsprechend der oben angeführten Tabelle mehr oder minder weit vom Hilus entfernt, ist meist (24 Fälle) variabel stark

nach lateral konvex, seltener (4 Fälle) lateral konkav, um sich dann gewöhnlich in die mediale Begrenzung der Nebenspalte fortzusetzen, wobei aber die beiden Linien einen nach aussen oder nach innen offenen Winkel miteinander bilden können, was von eventuellen Parenchymverbindungen der Lappen abhängig ist. Laut oben erwähnten Zahlen hängt Mittelappen und Hinterlappen in 21 von 36 Fällen durch Parenchym oder Pleurabrücken zusammen und diese Fälle sind es, in denen sich die Umschlagstelle der Pleura interlobaris superior in die Pleura interlobaris media direkt fortsetzt z. B. (Fig. 7—8).

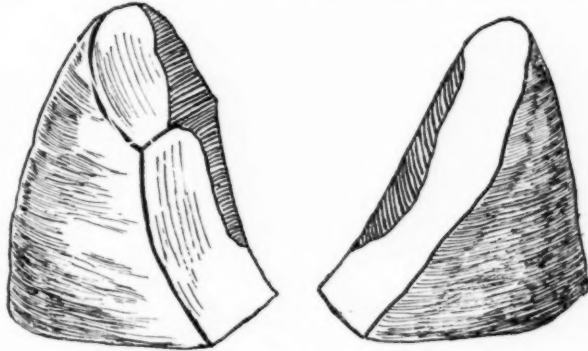


Fig. 13.

Form der Fläche (Fig. 13)

Wenn wir die durch die oben beschriebenen Grenzen gebildete Fläche betrachten, so ergibt sich links eine halbmondförmige Fläche, rechts die Form eines Halbovals, welches durch die Brücken zwischen Hinterlappen und Mittellappen Einschnürungen aufweisen kann. Vergleichen wir die Stellung, welche die beiden Längsseiten des Halbovals zueinander einnehmen, so finden wir, dass sie nicht in der gleichen Ebene liegen, sondern, dass die mediale Begrenzung stärker zum Horizont geneigt ist als die laterale. Dietlen gebraucht hierfür die richtige Bezeichnung: propellerförmig.

Wölbung

Die Fläche der Hauptspalte rechts ist keine ebene, sondern sie zeigt 2 Aushöhlungen von variabler Krümmung, kranialwärts gerichtet. Die obere ist in der Regel stärker ausgeprägt und führt allmählich in die Fläche der Mittelspalte. Ein Grat des Hinterlappens trennt in 10 von 26 Fällen die beiden Höhlungen und dieser Grat entspricht genau der Anlegungsstelle des Mittellappens. Der Grat ist in weniger gut ausgebildeten Fällen durch eine dorsale Wölbung des Hinterlappens ersetzt,

Er steht in keinem Zusammenhang mit den Verbindungen zwischen Hinterlappen und Mittellappen, er ist dagegen häufiger bei scharfer Zuspitzung der Schneide des Mittellappens zu finden. Dadurch setzt sich auch in vielen Fällen die Mittelspalte fast direkt in der Neigungsrichtung der oberen Hauptspalte fort.

Die Wölbung in transversaler Richtung ist sehr variabel und differiert häufig zwischen dem oberen und unteren Anteil der Spalte. In einer Reihe von Fällen ist die Fläche in der oberen Hälfte konkav, in der unteren konvex. Durch die konvexe Wölbung des Hinterlappens in seinem unteren Anteil kommt auch die Übereinanderlegung des Mittellappens und Hinterlappens zustande. Links ist die Propellerform meist viel weniger ausgesprochen. Die Längs- (Sagittal) wölbung ist nach vorne oben konkav, in der Hälfte der Fälle S förmig, d. h. oben konkav, unten konvex, ähnlich wie rechts. Eine Transversalwölbung ist hier meist nicht zu konstatieren. Abstumpfung der Kanten unten, wie rechts, nur etwas geringer.

Neigung

Auch bei der Hauptspalte lassen sich ähnlich wie bei der Mittelspalte 2 Neigungen feststellen, erstens eine Sagittalneigung, zweitens eine in der transversalen Körperachse. Entsprechend der Propellerform (Schiffsschraubenform) ist die Neigung medial etwas steiler als lateral und beträgt links auf die Horizontalebene bezogen circa 65 Grad, rechts ungefähr 55 Grad. Der Lateralabfall ist weitaus geringer, ist im oberen Anteil rechts steiler, unten viel geringer. Links ist sie meist gar nicht vorhanden, auch die Propellerform wenig ausgesprochen. Der Verlauf ist rechts im oberen Anteil mehr der Horizontale genähert, unten steiler, wodurch die bereits beschriebene Gratbildung zustandekommt. Wo dies der Fall ist, beginnt die Pleura interl. inter. an der Schneide des Mittellappenkeiles, begrenzt erst die Verbindungsbrücke horizontal von unten, um im mehr minder scharfen, nach unten aussen konkaven Bogen die mediale oder untere Begrenzungslinie zu erreichen. In 26 Fällen ist hier der Hilus bloss von Pleura überzogen, in 2 sind Parenchymverbindungen zwischen Mittellappen und Hinterlappen.

In den Fällen, wo anatomisch keine deutlichere Abgrenzung zwischen Pleura interl. superior und inferior kenntlich ist, springt der mittlere Teil der Linie buckelförmig lateralwärts vor, um dem Hilus auszuweichen. Ungefähr dasselbe Bild erhält man, wenn man die Hauptspalte der linken Lunge aufklappt: das Ausweichen der Linie vor dem Hilus, der in unseren Fällen links nur von Pleura und oft etwas stärker entwickeltem interlobären Bindegewebe von der Spalte geschieden ist. Die beiden Endpunkte sollen so ziemlich in einer Sagittalebene liegen,

stärkere parenchymatöse Verwachsungen am Beginn der hinteren oder am Ende der unteren Linie ändern natürlich die Einstellung der Punkte zueinander.

Für die Röntgenuntersuchung ist die hintere, nach oben konvexe Linie von Wichtigkeit, die rechts in $\frac{1}{2}$, links in $\frac{1}{3}$ der Spitzenzwerchfelldistanz ihre höchste Stelle hat und bei der Durchleuchtung in ventrodorsaler Richtung schärfer hervortreten müsste, wenn nicht der Skapularschatten hinderlich wäre, so dass ihre Beobachtung in dorso-ventraler Richtung leichter ist. Weiter unten, und zwar oberhalb des Zwerchfelles lateral von der Zwerchfellkuppe kann die Inzisur der Hauptspalte noch einmal sichtbar werden, und zwar rechts weiter lateral, links mehr medial.

Schlussbetrachtungen

Wir haben uns in unserer Arbeit bemüht, an einem grossen Material die Interlobärspalten in allen Einzelheiten zu studieren, haben Beobachtungen registriert, die scheinbar mit der Frage der Diagnostik, der Pathogenese und der Therapie der interlobären Erkrankungen nichts zu tun haben, deren praktischer Wert demnach scheinbar noch ein problematischer ist. Ob die Flächen gehöhlt oder gewölbt sind, ob sie sagittal oder transversal stärker abfallen, mag zunächst theoretisch und praktisch gleichgiltig erscheinen. Trotzdem lässt sich aber heute noch nicht sagen, ob nicht die bisher vernachlässigten Details mit daran schuld sind, dass trotz einzelner vorzüglicher Arbeiten das Problem der interlobären Pleuritis von einer wirklich erschöpfenden Behandlung noch weit entfernt ist, dass die Diagnostik noch lange nicht so ausgebaut ist wie etwa die Diagnostik der peripulmonalen Pleuritis oder der Pneumonie und dass auch über die Therapie noch lange nicht das letzte Wort gesprochen ist. Auch die Röntgendiagnostik ist nicht im wünschenswerten Mass ausgebaut und enthält Widersprüche die der Klärung harren, wenn auch schon, namentlich von Dietlen der richtige Weg eingeschlagen wurde. Eine gründliche anatomische Bearbeitung der Interlobärspalten lag bisher nicht vor: wir sind uns dessen bewusst, dass auch unsere Arbeit der Ergänzung bedarf, aber es ist ein Anfang gemacht und durch das weitere Zusammenarbeiten von Anatomen, Pathologen, Klinikern, Radiologen und Chirurgen wird auch die Frage der interlobären Erkrankungen ihrer Klärung entgegenreifen. Einige Erkenntnisse, die wir durch unser Studium gewonnen haben, erscheinen uns jetzt schon von Wichtigkeit. *Wenn man in Erwägung zieht, welche Differenzen im Aufbau der Interlobärspalten zwischen rechts und links* einerseits, und den gesondert gegliederten Spalten rechts anderseits bestehen, wenn man weiters das differente Verhalten der Spalten oder Spaltenabschnitte zum Hilus ins

Auge fasst, dann drängt sich einem unwillkürlich der Gedanke auf, dass das Bemühen, eine einheitliche, sei es klinische, sei es röntgenologische Symptomatologie der Pleuritis zu finden, auf ganz beträchtliche Schwierigkeiten stossen muss, da das, was für die eine Spalte gilt, bei der zweiten nicht mehr zutrifft, so dass es viel richtiger wäre, statt eine einheitliche Symptomatologie der Pleuritis interlobaris schlechtweg zu suchen, jede Spalte für sich zu behandeln, wofür ja ein Vorbild in der Arbeit von Ortner schon vorliegt, und das Bild der Pleuritis interlobaris princeps von der Pleuritis interl. superior, media und inferior zu trennen. So ist bei der Pleuritis interl. inferior und auch der media schwerlich eine intrascapuläre Dämpfung zu erwarten, wie sie z. B. Ortner für die Pleuritis interlobaria superior angegeben hat, und es ist auch nicht einzusehen, warum eine Pleuritis interlobaris sinistra einen bandförmigen Schatten geben soll. Wenn bei der Pleuritis interlobaris inferior medialwärts eine lufthältige Zone, wie dies Ortner ganz richtig angegeben hat, zu erwarten ist, so trifft dies für die Pleuritis interlobaris media oft nicht zu, es sei denn, es handle sich um eine seichte Spalte. Kommt noch dazu, dass sich ein Erguss nicht auf die ganze Spalte erstrecken muss, sondern in der Spalte selbst wieder abgesackt sein kann, dann kann man ermessen, wie wenig typisch ein Bild einer Pleuritis interlobaris sich präsentieren kann, in welchem Falle man eben alle Einzelheiten der interlobären Spalte, nicht nur die Inzisuren, sondern auch die Flächen, die mediale Begrenzung und das Verhalten zum Hilus kennen muss, um differentialdiagnostisch weiterzukommen. Das ist auch der Grund, warum wir alle Einzelheiten angegeben haben, und zwar auch solche, deren praktische Bedeutung uns heute noch nicht einleuchtet.

Wir haben versucht, eine neue Nomenklatur zu schaffen, haben es auch unternommen, neue topographische Gesichtspunkte zu gewinnen. Man hat bisher in topographischer Beziehung die Spalten auf die Thoraxwand projiziert und hat die Projektion für chirurgische Zwecke zu verwerten gesucht. Wir gingen von einem anderen Gesichtspunkte aus. Uns interessierten mit Rücksicht auf die Durchleuchtung die relativen Zahlen. Wo findet sich die Spalte rückwärts an der Lungenspitzen-Zwerchfellkuppelndistanz, wie verhalten sich die Spalteneingänge zur Lungenbreite, wie zur Lungentiefe? Wie verhält sich die Pleuraumschlagstelle zum Hilus, in welcher Höhe, verglichen zum Hilus, geht die Nebenspalte ab usw.?

Unser Bemühen ging dahin, die Topographie gewissermassen ins Röntgenologische zu übertragen. Da die Röntgendiagnostik schon heute eine grosse, wenn auch noch nicht allein ausschlaggebende Rolle in der Diagnostik der interlobären Erkrankungen spielt, ist der Versuch dieser Art der Topographie gewiss gerechtfertigt.

Zusammenfassung

Wenn wir die wichtigsten Ergebnisse unserer Untersuchung zusammenfassen, so ergibt sich:

Die Fissura interlobaris media hat Dreiecksform mit dorsaler, kurzer Basis und ventraler Spitze. Die Fläche ist nach vorne und lateral zu abschüssig und in denselben Richtungen kranialwärts konvex gekrümmt.

Die laterale Begrenzung oder *Incisura interlobaris media* (Spalteneingang) ist nach vorne zu absteigend, häufig medial zu verwachsen. Sie zeigt die Form eines liegenden S, ist aber auch gemäss der Thoraxwölbung gebogen.

Die hintere Begrenzung oder Schnittlinie mit der Hauptspalte stellt die Schneide des Mittellappenkeiles dar, steht transversal im Querschnitte des Körpers. Diese Linie ist aber häufig am Spaltengrunde nicht zu sehen, da sich Parenchym- oder Pleurabrücken vom Hinterlappen zum Mittellappen ausspannen.

Die mediale Begrenzung bildet den Pleuraumschlag vom Oberlappen zum Mittellappen. Sie ist sehr variabel und damit auch die sogenannte Tiefe der Spalte. Sie steht immer sagittal, kann den medialen vorderen Lungenrand erreichen.

Zum Hilus ist die Spalte derart eingestellt, dass ihr hinterster medialster Punkt dem Zentrum genau gegenüberliegt, daher »Hilusnaher Punkt«. Die Höheneinstellung der Spalte ist zwischen Hiluszentrum und unterem Hilusrand.

Die Hauptspalten weisen rechts und links sowohl in bezug auf ihre Verlaufsrichtung, die Krümmung ihrer Flächen, die Höhe ihres dorsalen Anteiles und die Schnittlinie der Lungenbasis Differenzen auf; beide sind annähernd längsoval, umkreisen an der medial gelegenen Pleuraumschlagstelle den Hilus, ihre Flächen haben daher annähernd Nierenform. Die linke reicht höher hinauf, der höchste dorsale Punkt liegt in einem Drittel der Zwerchfellkuppen-Spitzendistanz, die medial vordere Begrenzungslinie liegt weiter medial als rechts, die Lungenbasis wird weiter vorne geschnitten als rechts, die Neigung ist links eine steilere als rechts. Beide haben Propellerform, die rechte ausgesprochener als die linke.



Radiologische Methoden zur Bestimmung der Conjugata vera*

von

T. Klason, M. L.

Schon in den ersten Jahren nach der Einführung der Radiodiagnostik in die Medizin versuchte man sich an Beckenmessungen. Die ersten Schritte in dieser Richtung scheinen in Frankreich gemacht worden zu sein.

Um die perspektivische Vergrößerung des Beckens zu berechnen, legte FABRE einen Metallrahmen um das Becken, der durch Zacken in cm eingeteilt war. Der Rahmen war viereckig mit parallelen Seiten und wurde so angebracht, dass die vordere Seite gegen die Vorderseite der Symphyse und die hintere Seite auf eine Linie zu liegen kam, die die Spinae iliacae post. sup. miteinander verband. Nach FABRE liegt der Rahmen in dieser Stellung parallel mit dem Beckeneingang und muss also auf einer Platte dieselbe perspektivische Vergrößerung geben, wie dieser. Während der Aufnahme nimmt der Pat. Horizontallage ein. Auch der Rahmen soll mit seinen vorderen und hinteren Seiten parallel und horizontal liegen. Auf der Platte wird nun jede cm-Marke mit der entsprechenden auf der anderen Seite verbunden und auf diese Weise erhält man eine Einteilung des Beckeneinganges in Felder. Jedes Feld entspricht einem Quadratcentimeter und mit Hilfe dieser Feldereinteilung des Beckens wird auf mm. Papier ein Bild des Beckeneinganges aufgezeichnet, das dann dessen wirklicher Grösse entspricht. Eine sehr elegante Methode also, die aber ausserhalb Frankreichs keine grössere Verwendung fand.

FABRE'S Methode wurde von H. VARNIER einer Kritik unterzogen, der darauf hinwies, dass man niemals wisse, wo das Promontorium liege, und dass die Methode für asymmetrische Becken untauglich sein könne. Ausserdem liege das Promontorium meist etwas niedriger als eine Ebene

* Vortrag gehalten in der Sitzung der Nordischen Vereinigung für medizinische Radiologie, Kopenhagen, 24. 9. 1921.

durch die Lineae terminales. Er hat seine eigene Methode. Damit das Promontorium auf den Platten deutlich hervortrete, ist es nach ihm nötig, dass die Strahlenrichtung von hinten und kaudal komme. Das Promontorium löst sich da von dem Bilde des Sacrum. Um die perspektivische Vergrößerung des Beckeneinganges zu eliminieren, wendete er einen *langen Fokalabstand* an, 2.5 met. Es ist evident, dass nach VARNIERS Methode der einzige Diameter, der ziemlich exakt angegeben werden kann, der Querdiameter des Beckens ist. Dass die Conjugata vera in der richtigen Grösse abgebildet wurde, war nur ein Zufall, indem dieselbe und ihr Bild auf der Platte die Seiten eines gleichseitigen Dreiecks wurden. VARNIER scheint aber als Erster Distanzbilder beim Lebenden aufgenommen und auf die Anwendbarkeit der Methode in der gewöhnlichen Radiodiagnostik hingewiesen zu haben und er ist also als derjenige anzusehen, der die Distanzradiographie zuerst angewendet hat. VARNIERS Aufsatz datiert aus dem Jahre 1900.

Nach diesen frühzeitigen Versuchen, die inneren Diameter des kleinen Beckens zu bestimmen, haben sich später im wesentlichen *drei* Methoden der Beckenmessung entwickelt.

1) Photographische Aufnahmen bei einer derartigen Lagerung des Patienten, dass der Beckeneingang zur Platte parallel wird. (ALBERT, PFAHLER und J. R. RIDELL u. a.).

2) Anpassung der perspektivischen Methode MACKENZIE-DAVIDSONS für die Lokalisation von Fremdkörpern (MANGES 1910). Von dieser Methode findet sich eine grosse Anzahl von Variationen.

3) Stereoskopische Messungsmethoden mit Apparaten nach DRÜNER, PULFRICH, TRENDLENBURG u. a.

Nach der ersten Methode ist es, wenn man nur den Fokus-Plattenabstand und Abstand zwischen der Platte und der Conjugata vera kennt, offenbar sehr leicht, das Bild des Beckeneinganges auf seine wirkliche Grösse zu reduzieren.

Aber derselbe Einwand, der gegen die Methode FABRES erhoben worden ist, gilt auch hier, nämlich, dass man nie weiss, wo die Conjugata vera liegt.

Der Beckeneingang ist auch keine Ebene, sondern in der Regel liegt, wie bereits oben hervorgehoben, das Promontorium etwas unter einer Ebene, die durch die Lineae terminales gelegt wird. Durch Vergrößerung des Platten-Fokus Abstandes auf 2 m (HEYNEMANN u. a.) kann man allerdings offenbar die Ausführung einer leichten Rechenoperation vermeiden, aber diese Methode ist aus technischen Gründen bei vorgeschrittener Gravidität unanwendbar.

Das perspektivische Lokalisationsverfahren nach MACKENZIE-DAVIDSON ist ziemlich leicht auszuführen und erfordert keine umfangreichen Extra-

anordnungen. Die Anwendung dieses Verfahrens auf Beckenmessungen hat die Veranlassung zu einer ganzen MENGE von Variationen gegeben. Es sind kostspielige Apparate konstruiert worden, bei denen der ganze Strahlenverlauf bei der Plattenaufnahme durch Dräthe rekonstruiert wurde, andere haben die Lage der gesuchten Punkte durch Konstruktion auf dem Papier gefunden, u. s. w.

Die folgende Methode ist eine Kombination von Rechnung einerseits und Konstruktion auf dem Papier andererseits und basiert auf den Arbeiten von MANGES, RUNGE und GRUENHAGEN, GUILBERT, CHAMBERLAIN und NEWELL sowie LÉVY-SOLAL u. a. m.

Ihr Prinzip ist folgendes: Man bestimme, jeden für sich, die orthodiographische Projektion und den Abstand der beiden Endpunkte des gewünschten Beckendiameters von der Plattenebene. Ihr wirklicher Abstand ist dann leicht auszurechnen.

Es ist notwendig eine Doppelexposition vorzunehmen. Wenn dann der Fokus-Plattenabstand bekannt ist, und die beiden Punkte, wo der Normalstrahl bei den verschiedenen Expositionen die Platte trifft, markiert sind, (der Abstand zwischen ihnen ist natürlich gleich der Fokusverschiebung) so hat man alle Grössen, die für die Lokalisation des gesuchten Punktes nötig sind. Die Lokalisation geschieht am leichtesten durch Kombination einer Konstruktion auf dem Papier mit einer Rechenoperation. Die Methode erlaubt, in der Theorie wenigstens, die Messung jedes beliebigen Diameters.

Das Verfahren geht am besten aus folgender Beschreibung hervor.

Eine Beckenmessung nach dieser Methode erfordert eine Wechselkassette, ein Stativ, welches die Verschiebung der Röhre erlaubt, sowie eine Zentrierungsanordnung. Man nimmt zwei Platten nach einander auf und verschiebt zwischen den beiden Expositionen die Röhre um ein bekanntes Stück, wobei der Pat. die ganze Zeit ruhig liegen bleibt.

Bevor der Pat. auf der Wechselkassette gelagert wird, werden auf deren Deckel mit Bleimarken die beiden Punkte markiert, wo der betreffende Normalstrahl auftrifft; diese Punkte werden im folgenden die beiden 0-Punkte genannt und ihre Bestimmung erfolgt auf folgende Weise.

In einer offenen Holzschachtel, ungefähr von der Form einer Cigarrenschachtel und ca. 20 cm hoch, wird in eine der beiden quadratischen Flächen ein Loch gemacht und in demselben ein Fluoreszenzschirm festgeklebt. Auf der Aussenseite dieser Fläche werden 3 Schrauben eingeschraubt, derart, dass ihre runden Köpfe etwas herausstehen. In der anderen quadratischen Fläche ist ein kleines Loch. Rund um dasselbe werden nun 4 zugespitzte Bleistücke angebracht, mit den Spitzen einander nahezu berührend. Die Schachtel wird nun auf eine horizontale Unterlage placiert, und ein Lot aufgehängt, mit dem Faden genau im Zentrum

der 4 Bleistücke. Wo die Spitze des Lotes den Fluoreszenzschirm berührt, wird ein kleines Loch gemacht, gerade gross genug für einen spitzigen Bleistift. (Fig. 1).

Mit einer solchen einfachen Anordnung kann man den Normalstrahl gegen jede beliebige Fläche markieren, wenn man nur die Schachtel, die auf ihren drei Schraubenköpfchen ruht, im finsternen Zimmer so verschiebt, dass das Röntgenbild des Bleikreuzes, symmetrisch um das Loch zu liegen kommt. Der gesuchte Punkt wird so markiert, dass man einen spitzigen Bleistift in das Loch führt. Die Unterseite des Schirmes liegt nämlich nur ca. 0.5 mm von der Unterlage entfernt.

Will man statt dessen die Röhre über einem gewissen Punkt einstellen, so wird mit Hilfe einer Nadel das Loch im Schirm genau über demselben placiert, und die Röhre verschoben, bis das Bild des Kreuzes rund um das Loch im Schirme fällt. Mit dieser einfachen Zentrierungsanordnung habe ich so sichere Resultate bekommen, dass sich die verschiedenen Bestimmungen um weniger als 1 mm unterscheiden. Mittels eines in der Schachtel angebrachten Spiegels und einer Marke im Spiegel, wo die Lotlinie das Kreuz mit dem Loch im Boden verbindet, kann man den Fokus auch direkt sehen und die Zentrierung bewerkstelligen. Man kann auch über ein Visier gegen den Punkt visieren, wo die Lotlinie den Spiegel schneidet und die Röhre verschieben, bis das Bild des Fokus mit der Visierlinie zusammenfällt. Bei diesem Vorgehen sind die Bleistücke nicht notwendig.

Nachdem nun die beiden 0-Punkte durch Bleimarken auf dem Deckel der Wechselkassette angezeichnet sind, wird Pat. auf dieselbe gelagert, am besten in halbsitzender Stellung, und derart, dass die Verschiebung der Röhre in der Querrichtung des Körpers geschieht.

Es wird die erste Platte aufgenommen, die Röhre verschoben, die Kassette gewechselt, und die zweite Platte genommen. Der Pat. liegt die ganze Zeit ruhig. Die Endpunkte der Diameter, die man berechnen will, werden nun auf beiden Platten markiert. Beim Wiederaufsuchen derselben leistet ein Stereoskop gute Dienste. Die beiden Platten, auf denen die beiden Bleizeichen (die 0-Punkte) deutlich hervortreten, werden nun so aufeinander gelegt, dass die orthodiagraphisch projizierten Bilder der beiden 0-Punkte auf denselben Abstand wie die Fokusverschiebung kommen. Auf einem Pauspapier werden nun die Bilder der beiden 0-Punkte und die zu ihnen gehörenden Bilder der Endpunkte der gesuchten Diameter



Fig. 1.

markiert. Man bestimmt nun erst die »orthodiagraphische« Lage dieser beiden Punkte. Das geschieht am leichtesten durch Verbindung der Bilder mit dem resp. 0-Punkt. Der Schnittpunkt gibt dann die »orthodiagraphische« Lage der Endpunkte an. (Fig. 2).

Das geht deutlich aus Fig. 3 hervor. Auf der Plattenebene P sind O

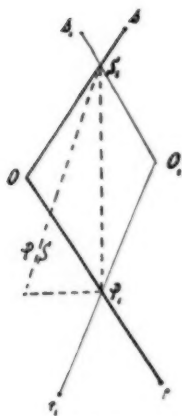


Fig. 2.

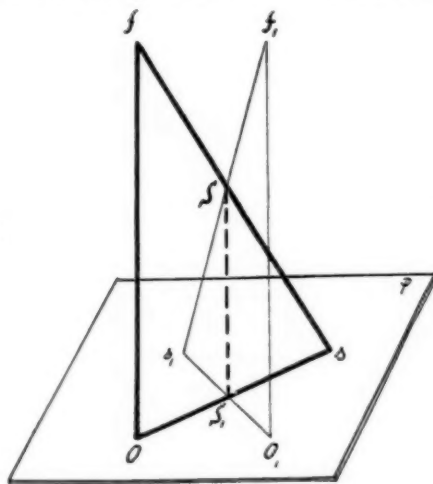


Fig. 3.

und O_1 die respektiven 0-Punkte zu f und f_1 , S der gesuchte Punkt, s und s_1 dessen Bilder, S_1 der konstruierte Punkt. Wenn nun die Dreiecke fOs und $f_1O_1s_1$ auf der Ebene P senkrecht stehen, muss auch die Linie SS_1 , in der sie einander schneiden, auf ihr senkrecht stehen, oder mit anderen Worten, S_1 stellt die orthodiagra-

phische Lage des Punktes S auf der Ebene P vor. Es erübrigt die Bestimmung der Höhe des Punktes S über der Plattenebene. Das kann auf verschiedene Weise geschehen, am leichtesten auf folgende: Die Dreiecke fOs und SS_1s sind ähnlich. Man erhält zur Bestimmung der Länge SS_1 folgende Gleichung:

$$\frac{SS_1}{fO} = \frac{S_1s}{Os}$$

(Os und S_1s wird auf dem Pauspapier direkt gemessen.)

Auf dieselbe Weise wird die orthodiagraphische Lage und die Höhe für den anderen Endpunkt des gesuchten Diameters bestimmt.

Die Schlussbestimmung des wirklichen Abstandes geschieht durch eine einfache Konstruktion (siehe Fig. 2). Die Punkte P_1 und S_1 sind bereits bestimmt. Die kleinere der erhaltenen Höhen wird von der grösseren abgezogen. Die erhaltene Zahl wird in cm senkrecht zu dem dazugehörigen Punkt (hier P_1) aufgetragen und die Länge der Linie PS ist der gesuchte Abstand. Es sind also zwei Konstruktionen und zwei Rechenoperationen erforderlich.

Sollte bei Konstruktion von Fig. 2 der eine der gesuchten Punkte in derselben Vertikalebene liegen, die durch den Fokus geht, so kommen die 0-Punkte und die Punkte s und s_1 auf dieselbe Linie. Die Konstruktion kann da nicht ausgeführt werden.

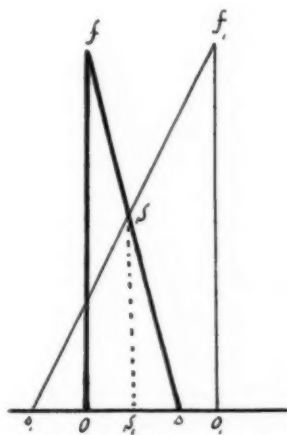


Fig. 4.

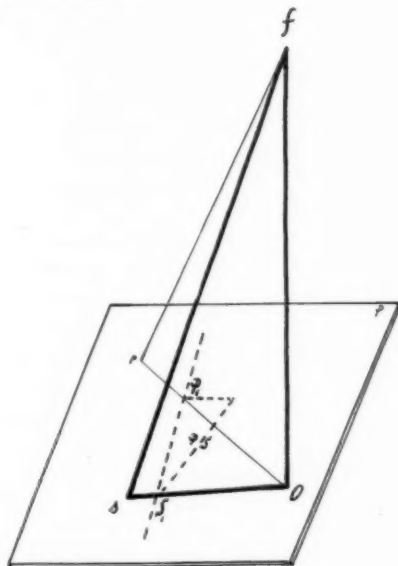


Fig. 5.

Die Lage von S wird dann am leichtesten durch Rechnung bestimmt. (Fig. 4) Die Länge SS_1 wird mit Verwendung der Dreiecke fSf_1 und s_1Ss bestimmt. Man erhält folgende Gleichung:

$$\frac{SS_1}{fO - SS_1} = \frac{ss_1}{ff_1}$$

Die Lage von S_1 wie früher.

$$\frac{S_1s}{Os} = \frac{SS_1}{fO}$$

Die weitere Bestimmung geschieht auf dieselbe Weise wie früher.

Es ist indes möglich, die Conjugata vera bei symmetrischem Becken mit nur einer Platte und sagittaler Strahlenrichtung zu bestimmen, wenn gewisse Vorkehrungen getroffen werden. Es braucht zu diesem Zweck nur auf der Platte die orthodiagraphische Lage der Mittellinie angezeichnet zu sein. Dieselbe dürfte leicht mit Bleimarken markiert werden können,

die mit Hilfe eines Trochoskops unter den Patienten geschoben werden, der dabei horizontal auf einer Wechselkassette liegen muss. Der 0-Punkt, der seitlich von der Mittellinie liegt, ist zuerst mittelst Bleimarke angezeichnet worden. Es wird eine Platte eingeschoben und exponiert. Unter Leitung der Bleimarken wird auf der Platte mit Bleistift die Mittellinie aufgetragen. Wenn der Deckel der Wechselkassette weit von der Platte liegt, muss die Verschiebung der Schatten der Bleimarken durch eine einfache Rechenoperation korrigiert werden.

Die Bestimmung der Conjugata vera ist sehr einfach. (Fig. 5). Es wird auf der Platte der 0-Punkt mit dem Mittelpunkt des Bildes des Promontoriums und der Symphyse verbunden. Wo diese Linien die Mittellinie schneiden, haben wir die orthodiagraphische Lage der gesuchten Punkte. Ihre Höhe wird auf dieselbe Weise bestimmt, wie früher. Die kleinere Höhe wird von der grösseren abgezogen und der Rest in cm senkrecht von der Lage des dazugehörigen Punktes auf der Mittellinie aufgetragen. Der so erhaltene Punkt wird mit der orthodiagraphischen Lage des anderen Endpunktes verbunden, und die Länge dieser Linie in cm. ist gleich dem gesuchten Diameter. Die Bestimmung ist also einfach, erfordert aber eine sichere Bestimmung der Mittellinie.

Diese Methoden leiden unter der Schwierigkeit der Feststellung der wirklichen Bilder der Endpunkte, spez. der Conjugata vera. Im Notfall kann man das Promontorium mittels eines Metallindex markieren, der in die Vagina gegen das Promontorium eingeführt wird, wie dies schon FABRE gemacht hat. Auf dem Bilde der Symphyse den Endpunkt der Conjugata vera zu bestimmen, kann auch in gewissen Fällen unmöglich sein.

Allen diesen Schwierigkeiten weicht man zum Teil aus, wenn man stereoskopische Messung anwendet. Eine solche erfordert jedoch einen kostspieligen Apparat und ein sehr genaues Arbeiten, um exakte Werte zu geben. Ausserdem ist grosse Übung in der stereoskopischen Betrachtung nötig, damit die Masse exakt werden. Ihre Vorteile sind, dass man, wenn alle Forderungen zum Erhalten eines tautomorphen Bildes erfüllt sind, ohne weiteres jeden beliebigen Diameter messen kann.

Durch Aufnahme eines Seitenbildes des Beckens kann man viel leichter als mit den oben angegebenen Methoden die Conjugata vera bei symmetrischem Becken bestimmen. Die Messung ist sehr einfach. Die Pat. wird auf den Rücken gelagert. Die Mittellinie wird auf der Haut, eventuell mit Hilfe von Durchleuchtung markiert. (Markierung mit Bleimarken nicht nötig). Auf die eine Seite des Beckens wird eine Platte vertikal, parallel mit der Mittellinie gestellt. Auf die andere Seite wird die Röhre so gestellt, dass in einer horizontalen Blendentube von 10 cm der obere Rand der Symphyse und die Spina iliaca ant. sup. gut mit-

kommen. In dieser Lage des Pat. liegt nämlich das Promontorium normal etwas dorsal und kranial von der Spina iliaca sup. ant. projiziert.

Der kürzeste Fokus-Plattenabstand und der Abstand Fokus-Mittelplan wird gemessen. Die Rechnung ist einfach. Auf der Platte sieht man das Promontorium und in der Regel auch die Rückseite der Symphyse; der Abstand wird in cm gemessen. Es wird dann (Fig 6).

$$\frac{SP}{sp} = \frac{d}{D}$$

Die Schwierigkeiten der Methode sind ausschliesslich technische.

Nach der perspektivischen Methode haben die Strahlen bei vorgeschrittener Gravidität zur Abbildung des Promontoriums in ventrodorsaler Richtung ein fast ebenso dickes Weichteilslager zu durchdringen, wie bei der Strahlenrichtung von Seite zu Seite, doch ist in letzterem Falle die Knochenmasse grösser.

Ich habe eine Lilienfeldröhre mit Belastung von zwischen 15 und 20 M. A. P., sowie hartem Licht und 2 mm Al. Filter angewendet, die Expositionszeit betrug zwischen 30—60 Sekunden.

Man muss eine möglichst kurze Expositionszeit und am besten doppelgedeckte Filme mit zwei Schirmen anwenden. Überexposition gibt ein durch Sekundärlicht ganz verschleiertes Bild. Das Entwickeln muss äusserst sorgfältig geschehen; bei Betrachtung der Platte vor der Fixation sind die Details oft besser zu sehen. Ein Vorteil meiner Methode ist auch, dass vorgeschrittene Gravidität keine Vermehrung der Schwierigkeiten bedeutet.

In 12 Fällen habe ich versucht, die Conjugata vera nach der letzteren Methode zu bestimmen; in sämtlichen Fällen geschah die Bestimmung von beiden Seiten. Der Unterschied hat niemals 0.5 cm überschritten. In 4 Fällen wurde das Resultat bei der Operation verifiziert und der grösste Unterschied war 0.6 cm. Es handelte sich da um eine sehr fette Patientin. In 2 Fällen — es waren ältere sehr fette Frauen — habe ich keine hinreichend deutlichen Bilder bekommen.

Ein Fall von Gravidität im 10. Monat, eine extrem fette Pat., bot keine erhöhten Schwierigkeiten. Man sah auf der Platte den Schädel mit dem Nacken gegen die Symphyse gestützt und das Gesicht beim Promontorium.

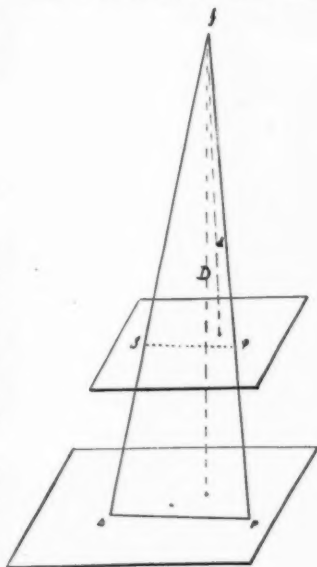


Fig. 6.

Durch möglichst vollständige Ausnützung aller Möglichkeiten zur Ausschaltung des sekundären Lichtes dürfte die Methode noch verbessert werden können.

Es gibt indes noch eine ganz andere Methode, die Diameter des kleinen Beckens zu bestimmen, ohne dass der Fokus-Plattenabstand oder die 0-Punkte bekannt zu sein brauchen. Im folgenden sollen ihre Prinzipien, in einer späteren Arbeit ihre praktische Anwendung auseinandergesetzt werden. Die Grundlinien sind folgende:

1) Wenn sich zwei Punkte in gleicher Höhe über der Plattenebene befinden und die Röhre parallel mit dieser verschoben wird, werden die Bilder dieser Punkte die gleiche Verschiebung zeigen. Die Bilder müssen auch paarweise auf Linien liegen, die parallel zu der Linie sind, längs welcher der Fokus verschoben wurde.

2) Wenn während der Exposition zwei Metallstäbe, von denen der eine ausserdem in geeigneter Weise mit einer cm Einteilung versehen sein soll, senkrecht auf die Plattenebene gestellt sind, werden die Bilder dieser Stäbe paarweise gegen die 0-Punkte konvergieren. Wenn ihre Bilder also durch gerade Linien verlängert werden, bis sie einander schneiden, so gibt dieser Punkt die Orthoprojektion des Fokus auf der Plattenebene an oder den 0-Punkt.

Zur Messung sind zwei Exponierungen erforderlich und zwischen beiden eine Verschiebung des Fokus. Der Fokus-Plattenabstand und die 0-Punkte brauchen, wie gesagt, nicht bekannt zu sein.

Bei der Messung werden die Platten in genau derselben Lage aufeinander gelegt, wie bei der Exponierung. Vorher soll man auf ihnen die Bilder der Endpunkte der gesuchten Diameter markieren. Der Abstand zwischen den beiden zu demselben Punkt gehörenden Bildern wird in cm gemessen. Auf den Bildern des mit cm-Masseinteilung versehenen Stabes wird die Marke gesucht, die sich bei den beiden Exponierungen um die gleiche Anzahl. cm verschoben hat. Die Höhe dieser Marke über der Plattenebene ist bekannt und ist der des gesuchten Punktes gleich.

Zur weiteren Ausführung der Bestimmung ist es nur notwendig, die Orthoprojektion des gesuchten Diameters zu kennen.

Zuerst werden die Orthoprojektionen des Fokus auf die angegebene Weise bestimmt. Die derart erhaltenen Punkte werden mit den dazu gehörigen Bildern verbunden und der Abstand zwischen den beiden so erhaltenen Kreuzungspunkten gibt die Orthoprojektion des gesuchten Diameters auf der Plattenebene an. Der Unterschied im Höhenabstand der Endpunkte des gesuchten Diameters von der Plattenebene wird senkrecht von dem einen Ende der erhaltenen Orthoprojektion aufgetragen und der Abstand in cm zwischen dem so erhaltenen Punkte und dem anderen Ende der

Orthoprojektion ergibt die wirkliche Länge des gesuchten Diameters. Die ganze Bestimmung wird also lediglich auf dem Wege der Konstruktion ausgeführt, ohne irgend welche Rechenoperationen.

Zusammenfassung

Mit Verwendung der Lokalisationsmethode MACKENZIE-DAVIDSONS wird ein Verfahren zur radiologischen Beckenmessung angegeben. Die Methode basiert auf den Arbeiten von MANGES, RUNGE und GRUENHAGEN, GUILBERT, LÉVY-SOLAL, u. a.

Es sind zwei Expositionen nötig. Zur Ausführung der Messung müssen der Fokus-Plattenabstand, die Fokusverschiebung und die Orthoprojektion des Fokus auf der Platte bekannt sein. Diese Punkte werden mit Hilfe einer Spiegelanordnung durch Bleimarken auf dem Kassettendeckel markiert. Zur Messung werden die Platten in derselben Lage ihrer Exposition aufeinander gelegt, worauf die Bilder der Bleimarken und die Bilder der Endpunkte des gesuchten Diameters auf Pauspapier angezeichnet werden. Ein Stereoskop ist dann oft nötig. Diese letzteren werden mit dem dazugehörigen Fokuspunkt verbunden und der Abstand der derart erhaltenen Kreuzungspunkte gibt die *Orthoprojektion des gesuchten Diameters* an. Die Höhe der beiden Endpunkte über der Plattenebene muss nun gleichfalls bestimmt werden. Auf der *Basis* des rechtwinkligen Dreieckes, das vom Fokus, seiner Orthoprojektion und dem Bilde des Endpunktes gebildet wird, kennt man die orthodiographische Projektion des gesuchten Punktes und hat dadurch alle Grössen, die zur Berechnung seiner *Höhe* über der Plattenebene nötig sind. Die geringere Höhe wird nun von der grösseren abgezogen und von dem einen Endpunkt der Orthoprojektion des gesuchten Diameters wird die erhaltene Zahl in cm aufgetragen. Der Abstand zwischen dem so erhaltenen Punkte und dem anderen Endpunkte der Orthoprojektion des Diameters ergibt den *gesuchten Diameter*.

Man kann die Conjugata vera bei symmetrischem Becken auch mit *einer einzigen* Exposition bestimmen, wenn *auf der Platte* die Orthoprojektion der Mittellinie und der Fokus vermerkt sind. (Der Fokus seitlich von der Mittellinie). Die Bestimmung geschieht auf analoge Weise, wie früher.

Wenn während der Exposition zwei Metallstäbe senkrecht auf die Plattenebene gestellt sind — der eine derselben mit einer cm. Markierung versehen — kann man die Bestimmung auch durch eine Konstruktion bewerkstelligen, ohne den Fokus-Plattenabstand und die 0-Punkte zu kennen. (Näheres im Artikel).

Durch Aufnahme von *Seitenbildern* des Beckens hat der Verfasser mit Anwendung von hinreichend hartem Licht und vorsichtiger Entwicklung Bilder erhalten, auf welchen sowohl die Symphyse als das Promontorium mit genügender Deutlichkeit hervortreten. Es war so bei symmetrischem Becken möglich, die *Conjugata vera* zu bestimmen, wenn die Platte parallel mit der Sagittalebene des Körpers gestellt worden war, und der Fokus-Plattenabstand sowie der Abstand Fokus-Mittellinie bekannt waren.

Das Wichtigste der einschlägigen Litteratur.

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A Peculiar Characteristic Metatarsal Disease*

by

H. J. Panner M. D.

(Tabulae XIX-XXII)

The material on which the present treatise is based has been collected during the last three years or thereabouts in which I myself have had the opportunity of examining 10 patients (5 in my private practice and 5 at the Roentgen Clinic at the *Rigshospital*) suffering from this particular metatarsal complaint. Roentgen pictures of 3 other patients also suffering from the said complaint have further kindly been placed at my disposal, one from '*Finsen's Clinic*' by the chief physician, Dr. REYN), another from the *Roentgen Clinic at the Bispebjerg hospital*, and a third from Professor FISCHER's private clinic. Ten of these thirteen patients were children, three adults. The immediately following statements refer to the not fully grown patients, the histories of whose complaints are so much alike that all of them are known if one is known. Afterwards I shall proceed to mention the cases of the three grown-up patients.

I shall begin by describing one of the histories:

A. L. V. a twelve-year-old girl. Family sound. She had herself never suffered from diseases which seem to stand in any relation to the present one; she had especially never suffered from rachitis or shown any symptoms of tuberculosis. In the summer of 1920 the patient, when walking, suffered from pain in a place corresponding to the 2nd right metatarso-phalangeal joint, although no traumatic cause could be proved. The pains never appeared when the foot was at rest, and were on the whole not marked enough to cause her case to be examined. When the pain, however, continued, a physician was consulted about three months after the beginning of the disease, and she was referred to me for an examination with roentgen rays.

The patient was of perfectly sound and indeed of fairly robust appearance, well grown considering her age, and showed no symptoms

* Read (in abbreviated form) at the II meeting of 'Nordisk Forening for medicinsk Radiologi' and in 'Dansk kirurgisk Selskab' 15 October, 1921.

of tuberculosis. The lung stethoscopy was normal. PIRQUET negative. Symptoms of disease were on the whole only to be found at the 2nd right metatarso-phalangeal joint round which there was an inconsiderable swelling without any sign of inflammation such as heat or redness of the integuments. There was some soreness on pressure, corresponding to the articulation, a slight pain with active and passive movements of the joint, which were somewhat limited in extent. No other joints were affected.

On November 18, 1920, *roentgen examination* of her feet shows pathologic changes in the said joint only, and the changes are as follows (Fig. 1): The articular surface of the capitulum strongly flattened, *capitulum* considerably distalo-proximally shortened, clumsy with somewhat irregular contours, here and there indented but everywhere sharply outlined (Fig. 2). The structure differs from the normal, showing in part irregular spotty rarefactions, and in part more condensed areas distally or proximally to the rarefactions. The *line of the epiphysis* is less distinct in this metatarsal bone than in the three other — fibular — metatarsals and the corresponding ones on the sound side. The *diaphysis* is perfectly natural without any thickenings or curves. The *joint fissure* corresponding to the flattening of the capitulum is slightly altered in shape, not clearly widened, at any rate not narrowed in. The base of the first phalanx shows no changes.

The patient's condition little by little improved so much that now she is almost quite well; and no treatment has been applied, she only used her foot as little as possible, was exempted from gymnastics and walked little. Now she can walk without any inconvenience worth mentioning, the tumour round the joint has passed away, there is no soreness on pressure, but there is a slightly diminished mobility in the joint, especially in respect to plantar flexion.

On April 9, 1921, the *roentgen examination* (Fig. 3) shows a still more flattened and clumsy capitulum which, without any distinction, is continued into the diaphysis which is thickened in its distal third by periosteal stratifications. The line of the epiphysis is now perfectly effaced in contradistinction to all the other corresponding ones which are still distinctly open. The clearings in capitulum are smaller, the condensed places more prominent.

On August 16, 1921, the *roentgen pictures* (Figs. 4 and 5) show a more intimate fusion of epi- and diaphysis, of whose homogeneous thickening the periosteal origin was no longer distinctly seen. The capitulum's structure approaches the normal, but there are still small, irregular, condensed areas. The articular fissure almost seems to be slightly widened, and on the dorsal side of the joint there is a faint shadow of about

the size of a hemp seed, presumably corresponding to ossifications in the capsule (fig. 5) but there were no remarkable alterations of the first phalanx.

The histories of the diseases and the roentgen findings in my first group of patients are, as already mentioned, of a very homogeneous character, and I think myself justified in representing their complaints as a well-characterized disease, the symptoms of which I shall mention. *The illness arises in perfectly sound individuals* who show no clinical symptoms of tuberculosis, syphilis or other diseases in the constitution. With only a few of the patients have WASSERMANN'S and PIRQUET'S reactions been tried; the former was always negative, the latter positive in several cases; but as it appeared negative in a few cases, and as the patients in whose cases it was positive showed no other clinical signs of tuberculosis, it may certainly (when connected with the perfectly satisfactory clinical progress of the disease and the roentgen picture) be justifiable to consider all connection between this disease and tuberculosis as out of the question. *The complaint arises before the growth is completed.* All the ten patients were girls at the ages between 10 and 14 years. *It begins spontaneously*, often gradually, rarely more suddenly as, for instance, after a walk; but I have been unable to ascertain any certain traumatic origin in any case, only in a single history of the illness is there a possibility of a trauma proper as cause, — the patient having hurt her foot a few months prior to the appearance of the symptoms, but between the time when the patient consulted a doctor and the trauma there was a period of about a month and a half entirely without any symptoms. The disease *begins with pains when walking*; in the vast majority of the cases in a place corresponding to II metatarso-phalangeal joint, the only case observed with another localisation is one of my own patients, where the III metatarso-phalangeal joint was affected. The pains are generally moderate, never found when the foot is at rest, and are consequently left unheeded in the beginning and most frequently several months pass before a doctor is consulted. In this respect it is very suggestive that only one of the 10 patients was placed in a hospital, all the others were ambulant. There is a distinct, though not strongly marked swelling *corresponding to the articulation concerned*, particularly on the dorsal side where there is further found a soreness on pressure, sometimes fairly marked — but never symptoms of inflammation of the integuments. *The movements in the joint*, especially plantar flexion, are generally somewhat limited, and passive movements to the extreme degrees accompanied by pain; in some cases movements

to the side were remarkably painful. *The general health of the patients is not affected*, the whole disease makes an extraordinarily mild impression, and in several cases it was without any real therapy brought to an apparent standstill, and improvement has appeared in all cases under observation. *The progress* is very chronic, may certainly take a couple of years and so little invalidity is generally left — mostly in the form of a slightly restricted plantar flexion — that the patient is not at all inconvenienced by it and can take long walks and bear other exertions, as, for instance, dancing. It is characteristic of this in common with several other foot complaints that the patients are indeed hampered in their walk, but bear cycling excellently, the foot being spared the weight of the body.

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With regard to the *roentgen picture of the disease*, I think I have seen it in all stages though not in one patient, yet I have in a few cases (thus in the one stated) had an opportunity of repeatedly examining the patient from a very early stage up to almost the last stage, and I think with certainty that I have ascertained the following:

The primary seat of the disease is undoubtedly the capitulum metatarsi which is always seen affected from the earliest beginning of the disease. There is more or less *flattening of the distal part of the surface of the joint*, making the capitulum more clumsy in shape and shorter distaloproximally than is normal. *The structure of the epiphysis* also shows changes; in the beginning of the disease indefinite condensed areas are found only in the middle of capitulum (fig. 6), corresponding to the place where the ossification in the epiphysis originates, a stage which presumably will comparatively rarely come under observation as the disease will scarcely offer any clinical symptoms to speak of so early. At a later stage the changes in the structure become much more distinct; besides growing condensations irregular rarefactions appear (fig. 1), very often a picture arises which resembles a compression — or a depression — fracture of the distal part of the surface of the joint which is seen to be condensed, flattened, more or less irregularly shaped, at the back bounded by a similar irregular rarefaction in the shape of spots or stripes, which again at its back is bounded by condensed areas (fig. 7). *The joint surface of capitulum* therefore often becomes undulating, *the contour of capitulum* uneven, in places indented, serrated, but not effaced, always strongly outlined (figs. 7, 13). *The joint fissure* naturally suffers changes too, most often it becomes widened in the middle, very often in toto, it is at any rate never narrowed in. *The diaphysis* is never changed at the beginning of the disease: in the course of the disease

periosteal stratifications may appear at an earlier or later stage, but they are presumably comparatively rare. They very often cause a homogeneous thickening of the distal part, which then without a distinct transition is continued into the capitulum (fig. 4). The periosteal stratification is more rarely seen as an irregular thickening in the middle of the diaphysis (fig. 9). *Synostosis between the epiphysis and diaphysis* frequently takes place earlier than in the case of the corresponding epiphysis lines (fig. 3, 7). *Lasting deformation of the capitulum* always remains to a greater or smaller extent — often but slightly — but the structure again becomes perfectly normal, first the rarefactions disappear and afterwards the condensations are replaced by a normal structure (figs. 8, 9). *Atrophy of the bones* of both the metatarsals concerned as well as of the other bones of the diseased foot I have seen once only (fig. 6). During the later part of the progress *deformations* of the base of the first phalanx (fig. 9), reminding one of *arthritis deformans*, may be seen as a kind of secondary change, as well as shadow formations which must be considered due to ossifications in the capsule (fig. 5); but the joint fissure is never narrowed.

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Only very little is found on similar cases in the literature. KÖHLER¹ mentions in 1915 quite shortly that pathologic conditions may appear, causing a deformation of the capitulum metatarsi, but does not treat it further until in 1920 at the Roentgen Congress^{2,3} in Berlin, when he gives his opinion at some length on the basis of observations of six patients who suffered from pains in II metatarsal and II metatarsophalangeal joint. Four of these patients were grown-up individuals (between 21 and 45 years), the others 10 and 16 years respectively; in the case of the latter whose roentgen pictures were given to KÖHLER by GRASHEY, the complaint was two-sided. In all cases the disease showed a markedly chronic and mild progress, and in none of the cases was it possible with certainty to prove any trauma as cause of the disease.

The roentgen findings are sketched out and KÖHLER describes the characteristic point in the roentgen pictures as follows: the base of the first phalanx has lost its regular round shape, is more oblong than is normal, the joint fissure is widened, the capitulum metatarsi is flattened and often highly irregular and rugged, it is shortened and is without any clear transition continued into the diaphysis which is homogeneously

¹ Grenzen des norm. u. Anf. des pathol. im Röntgenbild. II Aufl. 1915.

² Verhandl. der deutsch. Röntgenges. 1920.

³ Münchn. med. Wochenschr. 1920. Nr. 45.

22 — *Acta Radiologica*. Vol. I. 1922.

thickened in its distal half, often also somewhat curved. Small detached shadows correspond to ossifications in the joint capsule.

WEIL¹ reports 2 cases. One is about a 25-year-old man who never before has shown symptoms of a similar description, but who in performing jumping exercises feels pains in his right II metatarso-phalangeal joint. The pains are very intense, so as almost to make walking impossible; tumour and soreness on pressure of the joint, as well as limited function, are observed. The roentgen picture shows a generally very thickened and curved metatarsal, at the distal end of which the diminished and highly deformed capitulum forms the extremity without any clear distinction; the joint fissure is well preserved, base of first phalanx somewhat deformed.

The second case is that of a 16-year-old girl where the complaint arises spontaneously, producing deformity of the capitulum, but no distinct changes in the diaphysis.

Further, FROMME², adding a sketch of apparently the same complaint, mentions it as a result of late rachitis in similarity with other complaints as coxa vara, genu valgum, CALVÉ-PERTHES's hip complaint and others, but does not treat more closely of its clinical or roentgen picture.

Only KÖHLER enters into close consideration as to the course of the disease, which he thinks is as follows: the primary point is a prolongation and thickening of the distal half of the diaphysis, traumatically a flattening of the distal part of the capitulum takes place, involving the articulation in the process, and changes appear in the joint capsule and first phalanx, reminding one of an arthritis deformans with well preserved joint fissure. In his attempts at explaining the real nature of the suffering, KÖHLER, naturally, especially considers the thickened and prolonged diaphysis, and he dismisses, certainly correctly, the idea that tuberculosis or syphilis might be the cause; the whole clinical course and the roentgen pictures absolutely go against it. The same applies to osteomyelitis. KÖHLER also considers arthritis deformans localised to this one joint improbable, also because the joint cartilage in such so chronically progressing arthritis would be involved and cause the joint fissure to be narrowed in. I cannot quite agree with him there. We very often in 'hypertrophic' forms of arthritis deformans, accompanied by considerable deformations and osteophytic formations, see the condition exist through many years without any narrowing of the articular fissure.

KÖHLER concludes his statements by declaring the nature of the disease enigmatic and falls back upon very problematic and theorizing explanations of a possible primary hypertrophy of the diaphysis.

¹ Fortschr. a. d. Geb. d. Röntgenstr. B. XXVIII. H. 2.

² Deutsche med. Wochenschr. 1920.

WEIL seems after the observation of his first case to agree with KÖHLER's view as to the primary seat of the suffering in the diaphysis, but he is as unable to find any sufficient explanation of the changes in the latter, and thinks it may possibly be a result of an old fracture or 'foot-tumor which, indeed, is not found among soldiers only'.

In one of KÖHLER's and both of WEIL's cases there has been an opportunity of making histological examinations where resection of the joint was undertaken, but no light was thrown on the nature of the complaint in this way, as only strong connective tissue was found in the capsule as well as new ossifications both in the latter and in the joint bones. No sign of tuberculosis was found. When describing the resection preparation from one of his grown-up patients, WEIL remarks that, as far as it was possible to judge, it seemed a question of a process long ago concluded, and KÖHLER's observations in a few cases where, by means of roentgen examinations at an interval of many years, he finds the roentgen pictures perfectly similar, seem also to indicate little change in the process of the disease throughout the years when found in grown-up patients.

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In my opinion KÖHLER's view of the process of the disease is quite erroneous, probably because he has been unfortunate enough to observe it (or rather its last stage) in grown-up patients. He has not had the opportunity, as I have to a great extent, of seeing the earliest stages. Indeed, I do not doubt that what KÖHLER describes in his grown-up patients is the result of the condition which I have seen in its origin in my ten not fully grown patients. It seems quite unnatural to me that two different complaints should exist in this very joint, and there is scarcely any doubt that the changes described by KÖHLER may be the last stage of a complaint, the origin of which took place unheeded at a much earlier age than that at which KÖHLER had it under observation. There seem to me to be sufficiently convincing features in this and analogous diseases which bear out the correctness of the views stated here. KÖHLER himself thinks that it is the same condition he describes in his four grown-up and two not fully grown patients, as he states that the disease is found in patients 'between 10 and 45 years'. He has not seen what seems to me the right thing, that the origin of the disease is always found before the completion of the growth, most often at the age of 10—14 years.

As to the *primary seat of the complaint*, I consider it without any doubt to be the capitulum. In the cases of all my patients of the first group the already mentioned characteristic changes, deformation and changes in the

structure, were found in the capitulum. In one of these patients, examined only for the first time about six months after the beginning of the disease, was perhaps also a faint thickening of the most distal part of the diaphysis, in all the other cases the latter was normal. In the case I have reported in detail I have shown how such a thickening of the diaphysis can appear in the course of the disease, and an earlier examination of the above named case would certainly have shown natural conditions in the diaphysis.

The pathologic changes in the articulation must be considered as arthritis secondary to the disease in the capitulum. In none of my not fully grown patients were there any changes at the first examination in the first phalanx or shadows which might be due to ossifications in the capsule, while at later stages I have been able to prove such changes. In fig. 9, which shows the picture of a patient whose disease was brought to a temporary standstill at any rate, deformation of the base of the first phalanx is distinctly seen, and fig. 5 shows the shadow of ossification of the capsule. We thus see how out of the original disease in the capitulum the changes can develop secondarily, which KÖHLER describes as characteristic of the disease described by him both with regard to the diaphysis and the articulation.

My second group of patients, including the three grown-ups, seems to me a good supplement to my first group. In two of the cases (male patients) there had never been symptoms of any metatarsal disease neither during growth nor later, and it was quite incidental that an abnormality was discovered at a roentgen examination. One had pains in his right foot without it being possible to discover anything pathological at the roentgen examination, but at a comparative examination of the left foot (fig. 10) there was found a diffuse moderate thickening of the whole diaphysis, a clumsy-looking flattened capitulum, and consequently a somewhat irregularly shaped joint fissure. The other patient was examined for a fracture of the second right toe (fig. 11) and as an additional finding considerable changes in the metatarso-phalangeal joint are found consisting of deformations of both joint ends, especially of capitulum metatarsi which is very rugged and clumsy, ossifications of the capsule, strongly extended joint fissure, and diffusely thickened metatarsal. In spite of these changes the patient had felt no inconvenience.

With regard to the third patient the history of her disease forms in a way the connecting link between my two groups. It is a 27-year-old woman who, when 12—13 years old, spontaneously had trouble in a place corresponding to II left metatarso-phalangeal joint; she felt some pain when walking, but so little that it was quite neglected and no physician was consulted; the pain disappeared without any treatment

in the course of a year. Not until she is 27 years old does the pain return and is again so slight that she does not seek a physician, and it is indeed her position as a nurse, with easy access to a roentgen examination, that causes her to be examined, and (fig. 12) at the examination great changes are found in the said joint, a clumsy deformed capitulum metatarsi, considerably widened joint fissure, and a slight deformation of the base of the first phalanx. That the complaint of this patient and that of the two others is of the same character, and that its origin goes back to an age before the completion of growth, I think must be considered more than probable, and the disease can accordingly progress quite unheeded in the first as well as at later stages.

The fact that a disease, which may involve such considerable anatomic changes, exists without any symptoms should not cause much astonishment, when it has been repeatedly seen how little inconvenience it causes, and in that respect it is indeed not without analogies. Its similarity with CALVÉ-PERTHES's hip trouble was noticeable to me from the very first case I saw, and the more cases I have seen the more have I been convinced of the relationship between the two complaints. The whole clinical course of these two diseases has striking points of similarity; both are found during the period of growth, *cause little intense symptoms only*, no strong pain, comparatively slight disturbance in the function, have a chronic progress and generally, without any special treatment, result in a spontaneous cure, as a rule with very slight or no restriction of movement. Also the roentgen picture shows in many respects a characteristic uniformity. In both cases the disease originates in the epiphysis with a flattening, and other changes in the structure very much alike, still in case of the metatarsal trouble as great changes as in the hip complaint are presumably never found. In both a more or less widened joint fissure is observed, the thickened collum femoris may remind one of the thickened metatarsal, and further a more or less marked deformity of the joint head (and joint cavity) is found when cured, very often without corresponding clinical symptoms. If we consider the pictures (figs. 13, 14) of the metatarsal complaint and the initial stage of a CALVÉ-PERTHES's hip-disease, the points of similarity are obvious.

Not infrequently roentgen examination of the hip-joint in grown-up patients shows deformities which very probably may be referred to a CALVÉ-PERTHES's disease begun at an early age and progressing without leaving any symptoms; also here can we thus find points of similarity between the two diseases. In the after-effects, too, analogous circumstances are found. SUNDT¹ thus quotes instances of pronounced arthritis deformans coxae which must be considered secondary to a CALVÉ-PERTHES's

¹ SUNDT: *Malum coxae CALVÉ-LEGG-PERTHES*. Christiania, 1920.

hip complaint, and he asserts, certainly correctly, that not a few cases of arthritis deformans coxae in comparatively young people are of this origin, agreeing with PREISER's view that it is the incongruity between the joint surfaces that disposes to the arising of these deformed types of arthritis. When not all patients suffering from these complaints which involve deformity of the joint extremities get an arthritis deformans, it must indeed be presumed that an individual disposition must be found to cause the latter. Circumstances seem to me to remind one of the development of traumatic arthritis, and the roentgen pictures of these diseases indeed highly resemble this form of deforming ('hypertrophic') arthritis.

I add from my own experience some roentgen pictures of grown-up patients who, in my opinion, suffer from the after-effects of a CALVÉ-PERTHES's hip-disease, pictures which seem very well to illustrate the relations described above.

The first one (fig. 15) is of a 20-year-old girl who was in Professor SCHALDEMOSE's department at *Rigshospitalet* with the diagnosis of arthritis deformans coxae, sin. There is a slightly deformed caput with perfectly normal structure and regular contours, but caput is subluxed upwards and laterally in the flattened joint cavity from which it is divided by a well-preserved somewhat widened joint fissure and there are no new ossifications. The roentgen picture of the other hip is perfectly normal. This patient never had symptoms of hip trouble till about 6 months before arrival at the hospital, when she began to feel pain in her left hip when walking, and showed a slight limp after exertion; no pains are felt when at rest. When the patient does not exert herself her walk is quite natural without any limp; mobility in the hip is found to the full extent with only a tightening and painful feeling with extreme movements. The points of similarity between the story of the disease and the roentgen picture of this patient and the circumstances of a metatarsal complaint which causes only slight changes seem unmistakable to me.

With regard to this special form of deformation of the hip-joint, I have met it several times in patients who never before have shown symptoms in connection with the hip, and I do not think that there is any doubt that it has its origin in a CALVÉ-PERTHES's complaint which has progressed without symptoms. The patients have always been referred for examination with suspected arthritis deformans, and have always been fairly young individuals (under 35—40 years).

Fig. 16 shows the final stage of a previous hip trouble in a 20-year-old man who, 6—8 years earlier, was treated for a tuberculous coxitis, and for three years was treated partly with extension, partly with bandaging. As will be seen, there is a more marked change than in

the preceding case, there is a deep joint cavity, well-preserved joint fissure, a beak-shaped deformed caput, a thick, clumsy collum femoris, and varus-position, but no osteophytic formations, and no signs of previously existing real destructions. A picture recently taken, five years after the present one, shows exactly the same condition, it is evident that a standstill was reached in the process of the disease long ago. Also the history of the disease indicates that, as the condition of the patient has not altered for many years, he does not feel ill but is somewhat invalid; there is some shortening of the extremity concerned and some restriction in the functions of the joint. The patient's original disease was scarcely a tuberculous coxitis, as such a complaint lasting for 3 years would certainly have caused a different deformation of the joint, a more irregular shaped caput, reparative ossification, narrowed joint fissure; it is far more reasonable to presume that it was a CALVÉ-PERTHES's condition which we know can cause changes similar to those described.

The last picture (17) is of a 56-year-old man who, at the age of 12, was treated for coxitis with confinement to bed, extension and bandaging for about a year. The treatment caused such a perfect cure that later he bore service as a soldier well, and on the whole was well till about 14 years ago, when he got a pain in the joint, was treated with vaseline injections for arthritis deformans, which cured him so well that not until a year ago had he any more symptoms. The roentgen picture now shows an enormously magnified mushroom-shaped caput sitting on a short thickened collum, articulating with the markedly flattened joint cavity and with well-preserved joint fissure. Also in this case I think a mistake has been made in the diagnosis of the original disease which was presumably a CALVÉ-PERTHES's hip condition and not tuberculosis. Both the history of the disease and the roentgen picture speak against the latter disease, as the existing deformation and the well-preserved joint fissure do not resemble the changes we generally find in connection with cured coxitis.

It seems to me that the histories of the disease of these three patients and their roentgen pictures offer so many points of similarity with the conditions found in the case of patients suffering from the metatarsal complaint described by me, that it cannot seem laboured, when comparing this with the analogies I have pointed out before, to place the two diseases in a close relationship to each other. That the metatarsal complaint causes more rarely such great changes as the hip complaint seems certain, but should not indeed cause any surprise, being presumably due to the fact that a considerably greater weight rests on the hip-joint than on the metatarso-phalangeal joint.

Judging by all criteria it seems natural to refer the two diseases to the category of conditions to which the roentgen examination was the first to draw attention, and reveal as characteristic of the time of growth — (though at various ages), namely, besides the two already mentioned, KÖHLER's disease in os naviculare pedis, SCHLATTER's in tuberositas tibiae, and finally the disease in the epiphyses of the vertebrae in the arcuate kyphosis described by SCHEUERMANN, all conditions which almost always used to be suspected of being of tuberculous nature, but where the peculiar appearance of the roentgen picture has caused it to be proved with certainty that they are quite without any connection with tuberculosis, which is also confirmed by the general mild progress of the disease.

There has been little occasion for undertaking pathologic-anatomical examinations both of the hip complaint and the metatarsal complaint, and in the few cases where by resection there has been occasion to do so the histological examination, as already mentioned, has not been able to contribute to the solution of the question of the nature of the disease, accordingly conclusions must be drawn on the basis of the clinical progress and the roentgen finding, conclusions that must bear a strongly theoretical stamp.

A discussion of the very difficult question of the innermost nature of these complaints (constitutional anomalies of growth, insufficiency of endocrine glands, late rachitis etc.) fall outside the frame of this little article, but indeed it is probably correct to assume a common cause which, in certain places of predilection, in places of ossification, creates a locus minoris resistentiae, and the inevitable daily small traumas may then cause the onset of the symptoms; real traumas are rarely found to be the cause.

That the metatarsal disease is almost always found in the 2nd metatarsal may perhaps be due to the fact that the latter is the longest, and accordingly more exposed to small injuries than the others. As already mentioned, I have only in one case met the disease localised in III capitulum, and in all previously published it was the II capitulum that was affected. KÖHLER has, however, possibly once seen III metatarsal affected, as he mentions that he has seen such a capitulum deformed in the same way as is found in the disease of II metatarsal, but as he did not find changes in the diaphysis too he did not think that the disease belonged here, a conclusion which is certainly not correct.

Of the 22 patients (my 13¹ and 9 previously published cases) 15 were women and 6 men; in one case no sex is stated and the supremacy of

¹ During the printing I have had occasion to examine case no. 14 and 15, also in young girls of 12 and 16 years.

women is chiefly due to the fact that 11 of my 13 patients were women. In 14 the condition was right-sided, in six left-sided, in one double-sided, and in one nothing to that effect was stated.

*

In conclusion I shall only in a few words mention the treatment, which, according to my experience, need be very slight, as it seems necessary only to let the patients spare the foot as much as possible, i. e. only let them walk little, no dancing, gymnastics or the like, whereas they seem to bear cycling well. All patients whom I have attended sufficiently long to form an opinion have either been cured or are recovering through this rather negative treatment. The cure may possibly be hastened by treatment with thyroidin which indeed in certain cases of CALVÉ-PERTHES's hip-disease seems to have an effect in that direction. The secondary arthritis deformans may perhaps, judging by KOEHLER's and WEIL's articles, give an indication for resection of the joint, but it is indeed possible that, when one once has realised the certainly generally very mild progress of the disease, one will only very rarely need to resort to operative treatment, and it will at any rate never be necessary except at the later stages (in grown-up patients).

*

Post scriptum. The discussion in 'Dansk kirurgisk Selskab' in connection with my paper causes me to add the following remarks.

From one quarter (the chief physician, Dr FALBING) it was maintained that the condition described by me was possibly quite an ordinary traumatic arthritis. I cannot, however, admit the correctness of this assertion. The structural changes which are found in the epiphysis from the very first appearance of the complaint are never to be seen in connection with traumatic arthritis, and, as I have mentioned, a deformed arthritis need not appear, and it is perhaps only in the rarest cases that it is seen, often only a slight deformation of capitulum is found, but not the roentgenologic criteria of an arthritis deformans i. e. the osteophytes.

The chief physician, Dr. WESSEL, suggested that the primary feature in the disease was perhaps an epiphysiolysis which might arise as unnoticed as the well known fractures of the metatarsals that also chiefly are found in II metatarsal, and that the changes seen in capitulum were secondary, the clearings perhaps atrophy of bones. Nor do I think this explanation sufficient. When we consider the comparatively frequent epiphysiolysis at radius, and perhaps especially at caput femoris, epiphysis deformations may indeed be seen arising secondarily, especially

at the latter, but one never sees the structural changes described, nor condensations and clearings, which latter certainly cannot be considered atrophy of the bones which they do not resemble at all, they are undoubtedly expressions of anatomic changes. With regard to the periosteal stratifications they are indeed very well known at epiphysiolysis, but they are very rare in this metatarsal condition at the early stages, and it is indeed only by considering the latter that one can hope to make conclusions as to the origin of the disease. Secondly, there may evidently appear heavy deformations also of the diaphysis, as in WEIL's case, but nothing is known as to the stage at which they appear, and in none of my cases has there been the least sign of even the slightest shifting in the epiphysis line.

I will not say, however, that there cannot coincidentally with the capitulum abnormality be an additional abnormality in the epiphysis line, and what might indicate that, as Professor SCHALDEMOSE pointed out, is the too early synostosis formation found in many cases, and that at any rate in one of my grown-up cases a shortening of II metatarsal was found (fig. 12). This makes the similarity between the metatarsal disease and CALVÉ-PERTHES's hip-disease still greater. Indeed, in the latter case, no too early synostosis between caput and collum is found, but, on the other hand, by the irregular ossification an apparent growth of the epiphysis line into caput and collum, but I think indeed that both these conditions may have arisen through pathological conditions in the epiphysis line, and that the disturbances thus in one case involve irregular ossification, in the other too early ossification. That the early synostosis may involve shortening is, as mentioned, seen in one of my cases; and if with this in view we examine KÖHLER's cases we cannot, as far as the sketches allow us to judge of it, feel at all convinced that KÖHLER's explanation of the prolonged diaphysis is correct. I fancy that the incorrectness of his explanation may be due to the point that it is not possible, as he himself admits, definitely to show the transition between capitulum and diaphysis. If a shortening of diaphysis is found, it is probably due either to the too early synostosis or the shortened capitulum, or a combination of both these points, for, as already often mentioned, I have not been able to find any primary change of the diaphysis in very early cases.

Whether the thickening of collum femoris, as seen in CALVÉ-PERTHES's disease, is of the same periosteal origin as the diaphysis thickening in the metatarsal disease, I do not know, as I never have seen periosteal stratifications in cases of the hip-disease, but the idea of the homologous character of the thickening does not seem unreasonable to me, as the growth in thickness of the collum which belongs to the diaphysis arises



Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.



Fig. 5.

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Fig. 6.



Fig. 7.



Fig. 8.



Fig. 9.



Fig. 10.

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Fig. 11.



Fig. 12.



Fig. 13.



Fig. 14.



Fig. 15.

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Fig. 16.

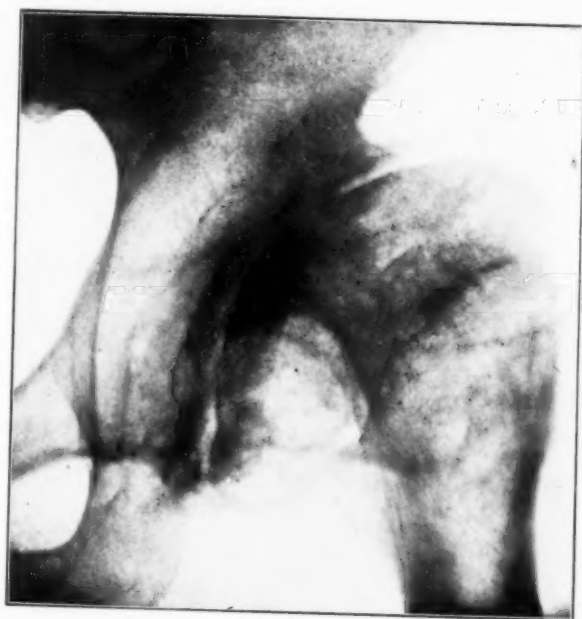


Fig. 17.

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from the periosteum. It may therefore be the case that the thickening here is just growing so evenly that the periosteal origin is not noticed as is the case with the growth of other tubular bones, whereas for some unknown reason the periosteal proliferation in the metatarsal disease may become so marked that it appears as such.

Summary

A metatarsal disease arising during the period of growth (at the age of 10—14) is found which almost always is localised to the 2nd metatarsal.

The disease falls into the category of diseases to which belong CALVÉ-PERTHES's hip-disease, KOEHLER's disease in os naviculare pedis, SCHLATTER's disease in the tuberositas tibiæ, and the spinal disease described by SCHEUERMANN.

The primary starting point is the capitulum metatarsi, that is, as in the other cases, in an epiphysis; secondarily, arthritis deformans-like alterations may appear in the joint as well as thickenings of the diaphysis; often the last stage is, however, only a more or less marked deformation of the head of the joint itself.

The progress of the disease is mild, the symptoms not infrequently so slight as to be left quite unheeded, and a thorough treatment is but seldom necessary.

The changes are therefore not infrequently found only by an accidental roentgen examination, and the latter gives (as is also the case in the abovementioned diseases) such characteristic pictures that the diagnosis will thereby be established.



Os Vesalianum Tarsi and Fracture of Tuberositas Ossis Metatarsi V*

by

Chr. I. Baastrup

(Tabulae XXIII—XXV)

In »De corporis humani fabrica» by ANDREAS VESALIUS (in the middle of the 16th cent.) the bone in the foot called the »Os Vesalianum» is described for the first time.

Scarcely any of the small bones which occasionally appear in the human body has caused so much discussion, so many theories and speculations, and the discussions show that the name itself has been used for different things.

VESAL'S OWN two pictures (Fig. 1) show the little bone in different situations. In the plantar picture the bone is seen to form the point of tuberculum ossis metatarsi V, in the dorsal picture it is lying medially to the well-developed tuberosity and looks like an os peroneum drawn too far in a distal direction. Whether VESALIUS has meant to show both forms of variation, or whether his dorsal picture is a drawing-mistake, is uncertain; anyhow his two pictures do not represent the same case.

Os Vesal. signifies, or, I might venture to say, ought to signify a smaller bone but rarely found and which is corresponding to the tuberosity os metat. V or the point of this and as a rule, in one way or another, articulating with os metat. V and os cuboid.

HEINRICH FISCHER says: Os. Vesal. does not form the tuberosity, but this is well developed in those cases where os Vesal. is found. This definition is I think unfortunate.

In VESALIUS' plantar picture, and in the cases described by SPRONCK and myself, os Vesal. is lying where tuber. V or the proximate part of this is situated. GRASHEY, who influenced H. FISCHER's work, states that os Vesal. forms a part of the entire tuberosity.

In the 17th cent. Vesal.'s bone is mentioned by the anatomical authors:

* Read at the 2nd Congress of the Nordisk förening för medicinsk radiologi in Copenhagen, 1921.

CASPAR BAUHIN, THOMAS BARTHOLIN etc., but I do not think that after VESALIUS anyone saw it until SPRONCK in 1887 described a case of a newborn female child (Fig. 2). In the right foot he found the fifth tuberosity¹ as a genuine, independent bone of cartilaginous origin and articulating with the os metatars. V as well as with the os cuboid. The child had hare-lip and cleft-palate as well as supernumary fingers and toes.

WENZEL GRUBER already before that time had spoken in different works about »os tuberositas metatarsi V proprium», but had never seen such an isolated bone in spite of his having examined 1130 right and 1119 left ossa metatars. V. Through the observation of different furrows on his preparations and through the study of the joint-facets he arrived at the conclusion that such a bone did exist. On the V. metatarsal bone of an old man he found marks showing that the point which had disappeared had formed an independent bone.

By the study of his great material he found that a proximal fibular epiphysis on the os metatars. V appeared in 14, 4%. (ISELIN has later on called this the »WENZEL GRUBER epiphysis», in this work it is called »the apophysis«).

GRUBER found marks of the apophysis on 124 bones of children from 10 years old till the age of puberty, but he only found traces in 6 grown-up persons.

In 1896 PFITZNER's great and very carefully written work about the bones of the foot appeared. Among a thousand ossa metatars. V he had not seen one single os Vesal.

On the basis of his material he gives the following conclusions as to the possibilities regarding the development of the tuber V.

1. Independent cartilage-formation, independent ossification and independent articulation with the os metatars. V and os cuboid.
2. Independent cartilage-formation, independent ossification and later synostosis with the os metatars. V.
3. Coalescence in the cartilaginous stage with the os metatars. V, independent ossification in the form of an epiphysis.
4. The tuberosity is in the cartilaginous stage coalesced with the os metatars. V, the special ossification-centres of the tuberosity appear late and only a small part of the tuberosity ossifies from the centre while the rest ossifies from the os metatars. V.
5. There is no ossification-centre in the tuberosity, but the outer part of this remains cartilaginous for some time.

¹ The latero-plantar part of the extremitas proximalis ossis metatarsi V is most likely the part which ought to be called the tuberosity V. The different authors referred to have, however, used the name differently; in this work I have used "tuberosity" now for the whole processus proximalis ossis. metatarsi V, now strictly for the tuberosity.

PFITZNER got one step further before his death, finding that there are two forms of epiphyses of the os metatars. V. In his posthumous works he writes about this: In late childhood there occurs an epiphysis at the proximal end of the os metatars. V. usually situated on the plantar side of the tuberosity where this approaches the ground in walking and standing». His opinion is that the weight of the body in walking has some influence on the epiphysis-formation. He maintains that this form of epiphysis must be clearly distinguished from a very rarely occurring bone-kernel in the proximal end of the os metatars V. This kernel, according to his opinion, must not be confounded with os Vesal, which somewhere in his work is characterised as »dies rätselhafte Skelettstück». PFITZNER has no idea as to what Vesal's ossiculum has been.

KIRSCHNER absorbs himself in meditations and sophisticated theories about the relationship of the body-weight to the latero-plantar epiphysis of the V tuberosity. He seeks parallels in the calcaneus epiphysis. His thoughts are not convincing. The development of other epiphyses takes place independently of weight-relationships and the localisation of the calcaneus epiphysis does not seem to one to support his theory. SCHOUWEY therefore keeps aloof from KIRSCHNER's theories. KIRSCHNER acknowledges two forms of epiphysis; he thinks that the case of an absent independent 5th tuberosity, described by GRUBER, indicates that the »epiphysis» concerned is of a special kind and in reality more like an independent partly coalescing bone.

He writes: (In anat. Hefte 1907) In the very exceptional cases in which the 5th tuberosity or the point of it forms an independent bone, a developmental phylogenetical description is lacking, — up to this date a similar constant skeleton-piece has not been found in other mammals. (This is wrong. EMERY had in 1901 found 5 tarsalia in the distal row in Didelphys).

With regard to VESAL's case KIRSCHNER comes to no conclusion.

HASSELWANDER, the heir of PFITZNER's preparations and notes, protests against the opinion that two kinds of epiphysis exist; he finds transitions between the two forms, but is ready to yield if proofs for the two forms can be procured.

HASSELWANDER's does not prove the transition between epiphysis and apophysis but seems to misinterpret some apophysical cases. The question is entirely confused, and his statistical figure of 40 % epiphyses with men and 20 % with women is quite insignificant, as ISELIN and SCHOUWEY later on show that the apophysis is relatively constant. KIRSCHNER and HASSELWANDER are mentioned in connection with PFITZNER because their investigations are in close response to his works; chronologically they belong to a later point of time than the following.

In 1904—1905 GELINSKY brought forward a case of roentgenologically proved, bilateral independent tuber. V in a boy 15 years old, Fig. 3. He carefully went through the extensive literature and found that his case was N. 3 after VESAL's and SPRONCK's, and the first bilateral os Vesal. published. GELINSKY's case has occasioned some doubts. SCHOUWEY thinks it is possibly »epiphyses» and ISELIN fancies it to be ossa peronea.

Up to 1906 the examination of all the questions concerned had indicated epiphysis-formations and independent bones, when LILIENFELD, the orthopaedic surgeon, appeared with a crushing critique.

VESAL's case was a mistake, SPRONCK's was a malformation, and GELINSKY's — was perhaps »epiphyses», but all the furrows mentioned by GRUBER and his proximal epiphysis were lines of fractures more or less grown together.

LILIENFELD's very energetic attempts to annihilate every belief in os Vesal. have imposed on, ALBAN KÖHLER, for example, who, in his book otherwise so plain and concise, treats the questions concerned in a very vague and uncertain way. When examining LILIENFELD's position, however, we find his critique of earlier works rather badly founded, and as his view apparently has modified the opinion on the question far too much, I shall go a little closer into his work (furthermore as his arguments are still used, as e. g. at the discussion in March, 1921, when I demonstrated my case number 1).

His views are partly of a more general theoretical nature, partly deductions on the basis of 5 cases of foot-injury in which he thinks he has proved fracture of tuber. V in all 5 cases. His theoretical views on the problem of the os Vesal. may be included in the following question: Do the ossa Vesal. described meet the claims which may be expected of an independent bone?

He now mentions THILENIUS' criterions for genuine skeleton-pieces:

1. Hyaline-cartilage origin,
2. a typical situation,
3. tracing of the element through the animal world,
4. that the element is bilateral.

LILIENFELD — and later on KÖHLER — concerns himself specially with the demand for bilateral occurrence. LILIENFELD thinks that by the aid of THILENIUS's criterions he has proved the non-existence of an os Vesal., he at least asserts that no one has hitherto proved that the bone exists.

To this may be added that SPRONCK has proved hyaline-cartilage formation in his case, probably the only one observed at a time and under conditions which have made it possible to make such an investigation.

It must be admitted that *os Vesal.* fulfils the claim regarding the typical situation.

Theoretical attempts have been made to find parallels to the *tuber. V* in the animal world. Thus BARDELEBEN has thought that the *tuber. V* might be a metatars. VI, compare GEGENBAUERS »Archipterygium-theory», but scarcely any essential work has been done before to trace *os vesal* through the animal world, at least I have not found anything about it in the literature.

In Urodela there may as a rule be found 5 separated tarsals in the distal row, also certain kinds of reptiles, extinct long ago (certain *proganosauria*), seem to have had 5 tarsals in the distal row.

SCHOUINSLAND states that in SPHENODON — the most primitive of reptiles now existing — may be found indications of a tarsal V, but that this later on coalesces with the metatars. V as tarsale I does with metatars. I (HOWES 1901).

5 tarsals in the distal row are usually found in tortoises too.

EMERY mentions 5 distinct cartilaginous centres in marsupial embryos (*Didelphys*). The question whether a coalescence between the tarsals IV and V or between the tarsal V and the metatars. V takes place, with reference to the different species of animals, is still unsettled.

BAUER maintains that the cuboid is originally a single bone. BRAUS and the majority with him that tarsals IV and V coalesce. The later authors (BÜTSCHLI: *Vergleich. anat.* — finished 1921) find it most likely that tarsal V is coalesced with metatars. V.

In the human body, as is well known, there are 4 tarsal bones in the distal row. If we may conclude that what we find in the lowest class, and in the developmental history oldest quadruped animals, and again in the foetal life of the primitive mammals, has also been present in the primitive forms from which the human body has developed, we may believe that a tarsal has disappeared during development.

It might be presumed that two tarsals had coalesced and formed an *os cuboid*. BLAUDIN speaks about a *cuboideum bipartitum*, but PFITZNER severely keeps aloof from this opinion: never in the literature has he found such a case mentioned, and never in his hundreds of examinations has he found the least indication of such a division of the *os cuboid*. He designates BLAUDIN's opinion as frivolous and dishonorable! KRAUSE — in BARDELEBEN's great anatomy — agrees with PFITZNER; we must therefore yield to PFITZNER's authority.

Furthermore the *os metatars. V* articulates mainly obliquely with the *os cuboid*, whereas — like the other metatarsals — it should be expected to articulate with its tarsal at the terminal surface.

SCHOMBURG shows clearly how the front part of *calcaneus* is lying

nearly against the tuber. V in the second foetal month. The entire proximal part of the os metatars. V is lying lateral to the cuboid. Then the calcaneus goes behind the cuboid., and the os metatars. V occupies an angular position towards the os cuboid (Fig. 4 — 5).

In the place where the vanished tarsal should have been lying, we now generally find the tuber. os. metat. V, or occasionally the os Vesal. It is easy to conclude then that os Vesal is the vanished os tarsale V which very seldom appears independently, being as a rule coalesced with the os metat. V. GRUBER and PFITZNER both mention this, and HASSELWANDER is so sure that PFITZNER is right that, only giving the reason that PFITZNER has stated it, he mentions the tuber. os. metat. V. among the tarsal bones.

The 4th criterion and the one most used against the existence of os Vesal is the claim for the element being bilateral only in GELINSKY's one case, and in Laquerrière's two cases this claim is fulfilled.

Whether THILENIUS is right in making this criterion is, however, very questionable. A case in my opinion parallel to the os Vesal. is that of a cervical rib.

This appears frequently — in my cases — unilateral, and so do many other atypical, abnormal or atavistic phenomena, as in the hand- and foot-skeleton, e. g. the small sesamoid bones. Hardly any evidence has been forthcoming showing that the factors which in embryonic life determine such a deviation from the normal course need to be bilateral.

Before I enter upon LILIENFELD's further views it is necessary to review the result which we have arrived at concerning the epiphyseal conditions of the tuber. V as well as to take the question of a possible fracture of the tuber. V. into consideration.

As it appears from the above, two kinds of formations resembling epiphyses may be found near extrem. proxim. os metat. V.

1. The »Apophysis», »the WENZEL-GRUBER epiphysis»: This is situated in shell-form on the latero-plantar side of tuber. os. metat. V. ISELIN and SCHOUVEY think it is constantly present at the age of 15 $\frac{3}{4}$. The bone-kernel lies in the tendon of musculus peroneus brevis, i. e. the apophysis is a sesamoid bone. (In ÅKERLUND's chart of 56 school-children aged 8—14 I found the apophysis in 12 children aged 11—14, as far as may be concluded from the reproductions of the roentgen photos. BORCHARDT in 1914 called it exceedingly rare; according to my experience it appears frequently, but at rather varying ages).

2. The very rare basal »epiphysis»: because of its rarity it is nowhere mentioned when it coalesces with os metatars. V. It is very noticeable that in a great percentage of cases it is found in grown-up people and accordingly is characterised as »persisting». (WENZEL-GRUBER, HEINRICH FISCHER etc.).

Among the ordinary genuine epiphyses »persisting» cases are very rare, though. In connection with children it is seldom heard of. SPRONCK's case is acknowledged as a genuine bone, SCHOUWEY who has examined several os metatars. V in children and ÅKERLUND who has made 56 such examinations have not seen it.

My opinion of this »epiphysis» is in fact that with closer examination it turns out to be an independent os Vesal. — compare my case No. 1, where the operation proved the presence of a genuine bone, whereas the roentgen photos showed a form exactly like the »persisting epiphyses» already described.

LILIENFELD and SCHOUWEY reduce the above-mentioned GELINSKY's Vesalbones to »epiphyses».

But what is then the difference between independent bones and epiphyses?

In reality it is very difficult, not to say impossible, to distinguish between the two, because transitions occur, viz. *independent bones may change into epiphyses of other bones*. The classical example of this is the cervical ribs which become epiphyses of the vertebrae.

The bones of the foot have a great tendency to synostosis, which makes it specially difficult to distinguish between bone- and epiphyseal coalescence. In questions of basal epiphysis or coalescing os Vesal. I shall not, however, go further into the difference between epiphyses and non-epiphyses, but refer to PFITZNER's and H. FISCHER's works.

It is difficult to believe that a roundish bone, strong and short as tuber. os. metat. V could easily break. A fracture like the typical marching-fractures of corpora os metat. owing to the anatomical conditions may not be expected here.

By movements upwards, downwards or medially of os metatars. V, extremitas proximalis os metat. V will not meet with any osseous resistance, and it is furthermore fastened with synovial capsules. If the bones are strained beyond the breaking-point it would sooner be expected that the thin and more delicate corpus os. metatars V should fracture. By a twist in a lateral direction of the os metatars V the fracture will most probably happen in the delicate corpus too. An examination of the roentgen plates from the 3 largest hospitals in Copenhagen during a series of years shows only a very few fractures of the 5th tuberosity or of the entire extremitas proximalis, but considerably more of the slender part of corpus metatarsi V.

A torn-off fracture (musculus peroneus brevis) may happen in a few cases, though a direct injury of tuberositas os. metat. V is stated in most cases. To make the diagnosis fraktura tuberositatis metatars V, the following must be demanded.

1. The presence of an injury, especially a direct one.
2. The usual local symptoms: pains, tenderness, swelling etc.
3. In the roentgen photo: Fracture lines of the usual — most frequently irregular — aspect.
4. Sharp edges at the ends of the fracture lines, at any rate immediately after the injury has taken place.

Whereas 1) a closer structure of the bones (corticalis) towards the dividing line, 2) round corners of corpus liberum immediately after the injury has taken place, disprove a fracture.

The usual symptoms: pains, tenderness on pressure, swelling etc. even if they are permanent for a longer period, are not sufficient to diagnose fracture in this place, as the same symptoms may occur when an os Vesal. happens to break off and causes a hæmatoma.

ISELIN describes a case of a girl, 13 years old, with a painful condition in the region of tuberosity of the 5th metatarsal bone. He thinks the growth is the cause of the pain, there was no trauma, but a »proximal epiphysis» or a bone-kernel.

If the fracture ends like a pseudarthrosis, a fibrous and no cartilaginous connection may be expected between the fragments.

A later osseous coalescence is no criterion for a fracture. An epiphysis separation may be succeeded by a coalescence of the epiphysis and diaphysis. An independent os Vesal. may furthermore coalesce with os metat. V — perhaps even influenced by the irritation of the separate body (my case No. 3). Reverting to LILIENFELD's 5 »fractures», which are published together with roentgen photos, it is regrettable that the cases are rather defectively described, e. g. the ages of the patients are not stated, and the reproductions are bad. A critical inspection of his roentgen photos will nevertheless give a surprising result.

In one case (fig. 2) HASSELWANDER states the patient's age to be 15 years. This is the only one of LILIENFELD's cases where epiphyseal lines may be observed in all the typical places. The »fracture» has in this case exactly the same appearance as an »apophyseal line».

Not finding anything similar in the other foot L. thinks that the apophyseal line is a fracture line. Most probably this case is an »apophysis». 2 years later LILIENFELD saw it completely healed, partisans of the apophysis-opinion would expect the same.

Picture No. 1 shows proximally a roundish body of os Vesal.-appearance; distal to this a little bone which proximally looks roundish, but distally sharp-edged.

The os metatarsale fragment is limited proximally by an uneven line (formed like stairs), laterally being perfectly *sharp-cornered*; medially, where the metatarsal touches the postulated os Vesal., the corners are

round. In my opinion the case is an os Vesal. and a fracture of the outer lateral proximal corner of the os metatars V. As the case was only treated 8 weeks after the injury had taken place a safe judgment cannot be made from the photo.

Picture 3 shows an os Vesal-like body separated from the remaining os metatars. V, as L. himself states, by a smooth and slightly curved zone some few millimeters broad. LILIENFELD says: »The fragment is as like the cases first described by WENZEL GRUBER as being 'persisting epiphyses', as one egg is like another».

But how does L. know that this is a fracture and not an »epiphyseal separation» or a separated os Vesal? L's reason for the diagnosis of fracture is that 2 years later the fracture had healed. Apart from this, according to the described incorrect reasoning, the roentgen photo taken 2 years later seems to show the same body still in the same place only closer to the os metatars.

Picture 4 shows a distinct and typical fracture proximally of the slender part of ossis metat. V and a body corresponding to the proximal part of tuber. V. The one with corpus connected part of the V. tuberosity is rounded on the proximal lateral edge. Nor is the described free body sharp-edged. The proximal fracture-fissure is nearly twice as broad as the genuine one. The distal border of the body mentioned is quite smooth and more distinctly drawn than the neighbouring structure (corticalis). It forms a curve. One can hardly believe that when an injury takes place, a round cornered fracture of tuber. V will occur together with a typical sharp-edged fracture more distal.

Picture 5 and 5a are so indistinct that nothing can be said about them, but L. informs us that 5 is »quite identical» with 3 — remarkable fractures, being quite identical!

It has also formerly been doubted whether LILIENFELD has interpreted the 5 cases correctly. KIRSCHNER doubts that No. 2 is right, HASSELWANDER No. 2 and 4, ISELIN doubts and so do I that any one of the 5 cases is understood correctly.

In the big »Handbuch der prakt. Chirurgie 1914» BORCHARDT writes in accordance with LILIENFELD about fractures which may easily be mistaken for WENZEL GRUBER's epiphysis. His illustration of such a fracture (fig. 599) is, however, not at all like the apophysis (fig. 600). His transverse fracture of the base (Fig. 601) is remarkably like the form several times described as the »persisting epiphysis». The fracture-line is straight, goes across through the thick part of the bone, apparently without any unevenness or side fissures; even the proximal »fragment» seems to have some corticalis towards the »fracture-line».

The reason why the differential-diagnostic questions nearly always are heard of in connection with injuries is, quite naturally, that the feet most frequently are examined when an injury has taken place, and if the examination concerns other things — as tuberculosis in the ankle-joint — the conditions of tuber V may easily be overlooked.

From 3 of the biggest hospitals at Copenhagen I have collected 8 cases diagnosed as fractura tuber. V (as the plates of No. 1 and No. 2 are not distinct enough to make a precise diagnosis, the cases are mentioned together with the undoubted fractures).

Case 1: Man 48 years. Injury on $\frac{9}{8}$ 19. A bicycle-accident: left foot was over-supinated but no direct trauma is mentioned. Swelling of the ankle, no pain corresponding to tuber. V.

$\frac{13}{8}$. Roentgen examination. (Fig. 6). The entire tub. torn off. The fracture-fissure gaping $\frac{1}{2}$ cm planto-laterally. The edges are not distinctly seen on the plate immediately after the accident, there seems to be corticalis towards the »fracture-line». No fracture anywhere else.

2 years later I examined the case (Fig. 7): The fissure was still gaping, the bone-limits between os metat. and the free body were still uneven and there was a condensed shadow-zone towards the »fissure line» on both bone fragments. No accessory bones. The right tub. looked natural.

If this is a fracture it should be a torn-off fracture. I believe it to be an os Vesal. perhaps loosened and dislocated, if a dislocation is present at all; the lack of pain signifies the reverse. Unfortunately, the picture was taken in only one projection immediately after the accident and the plate was not very good.

Case 2: Man 42 years old. Injury on $\frac{30}{11}$ 19. Fell off the tramway on the interior side of his left foot, and hurting it turned half way round but does not think he touched the ground with the exterior side at all. Swelling of ankle-joint and dorsum pedis. No pains about tuber. os. metat. V. Roentgen photo $\frac{17}{19}$ 19: (Fig. 8). Part of the point of tuber os. metat. V., as big as a pea, is separated from the remaining tub. by a diastasis about 2 mm broad. Smooth bone-limits towards the diastasis. The edges are not sharp. No condensed shadows round the edges. No fracture anywhere else.

$\frac{5}{7}$ 21. (2 years later): Tub. os. metat. V. forms a peculiar proboscidi-formed prominence which makes tuber. seem abnormally long. No accessory bones, the right tub. natural. Whether this is a fracture seems just as doubtful. The fact that the coalescence has taken place 2 years later may indicate a fracture or at least an irritation on this spot.

Case 3: Woman 53 years old. Injury on $\frac{31}{10}$ 20. Slipped, fell, turned on right foot, slight pains around tuber.

$\frac{1}{11}$. Roentgen photo: Contour-irregularity in the middle of tuber. V, jagged irregular fracture-line, extremely narrow but typical and running obliquely through the lateral and proximal part of tuber. (too undefined for reproduction).

$\frac{6}{7}$ 21. (1 year later): No signs of fracture-line. Natural tuber. os. metat. V, undoubted fracture — probably a torn-off fracture.

Case 4: Man 44 years old. Injury about $\frac{21}{8}$ 19. Made a false step when running upstairs. He had thin-soled shoes on and knocked his foot against the metal

at the edge of the stairs. Later on pain corresponding with the right tub. V, which is big, solid, sore and immovable. The skin discoloured.

¹⁵/₉ 19. Roentgen photo Fig. 9 (3 weeks later): A typical irregular gaping fracture-line separates a part of tuber. quite as big as a pea, fissure right-angled towards the fracture-line into the base of metatars V. The fragments are sharp-edged. 2 years later osseous healing.

Undoubted fracture.

Case 5: Woman 26 years old. Injury about ¹⁶/₆ 20. Turned over with a bicycle. Violent pains at once and swelling of the right foot. History very defective.

²/₇ 20. Roentgen photo. Fig. 10. Typical fracture almost like sharp-edged fragments, irregular fracture-line. Undoubted fracture.

Case 6: Man 16 ¹/₂ years old. Engine accident. Right foot into a cogwheel. Big open injuries, outer phalanx of first and second toe torn off.

²⁹/₅. Roentgen photo: Fig. 11 The entire tuber. and a piece of the latero-plantar part of the base are divided from the remaining bone by a typical irregular narrow fracture-line. The fragment-edges are sharp. The position good.

Case 7: Man 50 years old. Injury on ¹⁶/₉ 19 left foot. No history as the patient was sent home after the treatment.

The roentgen photo Fig. 12 shows a narrow fissure or fracture through tuber. V running almost parallel with the planto-lateral contour. No dislocation. The fracture undoubted.

Case 8: Man 43 years old. Injury at the factory. A sheave fell on top of him Fract. bas. metat. I and breaking off of metat. II. The lateral side of right foot shows a big hæmatoma.

²⁶/₆ 20. Roentgenogram. Fig. 13 (the day of injury); Tub. V. smashed — 2 transverse fractures with connecting fracture-lines. The position quite good.

The genuine fracture-lines are thus different in the different cases and the fractures are not alike as »one egg is like the other».

If I am right in my opinion as to many of the cases being wrongly considered fractures, os. Vesal. should be a far more frequent phenomenon than formerly supposed.

HEINRICH FISCHER published in 1912 2 cases of small os. Vesal., both resembling the dorsal picture in Vesal's production (os peroneum?).

1. Man 54 years old. Os Vesal. 10 × 5 mm.

2. Man 32 years old. Os Vesal. 6 × 3 mm.

The cases are not very well described and no roentgen photos are published, only a drawing of No. 1. H. F. saw once the base of metat. V as one in toto »persisting epiphysis»: woman 33 years old, no trauma, the »epiphysis» 8 × 18 mm. Furthermore was found an os peroneum. This case is like those described by me. The reason why H. F. calls his case »persisting epiphysis» is the likeness of the fissure to an epiphyseal line. No roentgen photo published in this case either.

The following cases further confirm my opinion that os Vesal. is not

as rare as formerly supposed. In 1916 LAQUERRIÈRE (Paris) and DREVON (Marseille) published two cases of bilateral os Vesal. 1. in a 51 years old man. The bone was very small, lying off and 2 mm from the tuber. V which was very long. Os Vesal. was not articulating with os cuboid. 2. in a 33 years old man, this being the biggest and most beautiful of the cases published up till now, os Vesal. forming the entire tuberosity. In none of those cases had there been pains or other pathological symptoms.

Case 1. A man 28 years old who has never injured his left foot complained in March, 1921, that for $2\frac{1}{2}$ years he had been troubled by a hard, firm, immovable and insensitive lump situated in the place corresponding to tuber. V. sin. It was mostly when putting on or taking off his shoes or when walking without them that he was troubled, otherwise he had no inconveniences. Roentgen photo $\frac{9}{5}$ Fig. 14—15. The point and the lateral part of tuber. V sin. is seen, isolated from the remaining part of metatars V, as a facet body nearly as big as a raisin. The edges are rounded, the fissure-line nearly straight and the picture resembles what is formerly by the authors described as »persisting basal epiphysis». On the left foot is further seen an os peroneum, an os tibiale extern, and an os calc. secund. Nothing similar on the right side where tuber. V is rather big.

Operation $\frac{11}{8}$. DR. EIKEN. The bone is extirpated: The accessory bone is nearly circular, about 2 cm in diameter. The entire exterior part is covered with ligamentary adherences and on top of this is found a small bursa. The bone is $\frac{3}{4}$ cm in the thick part and very much resembles in its form a patella en miniature. The inside of the bone is divided into two articular surfaces by a small crista and are covered with cartilage (microscopy PROF. ELLERMAN: fibro-cartilaginous covering on both articular surfaces). One of the surfaces articulates with a facet on the os cuboid. and the other with the outside of tuber. on os metatars V. This articular surface is a little broken near the connection with elevatorium. It is improbable that this strong tuber. V would fracture except by a vigorous trauma and the man states he had never injured his foot. The cartilaginous covering on both facets of the extirpated bone indicates a pseudarthrosis, and the character of the bone points to its being a genuine one.

This case is thus number 6 of those in the universal literature acknowledged os Vesal. and was demonstrated in March, 1921, in the »Danish Radiological Society». This bone is the first operated case.

At the Northern Chirurgical Congress in Helsingfors in July, 1921, the head-physician, SVEN JOHANSON (Göteborg), demonstrated an os Vesal. still larger and prettier than mine. This case did not at all look like an epiphysis but had decidedly the character of an independent bone; it resembled my case No. 4.

Case 2. In April, 1921, I was inspecting some roentgen films taken for the purpose of advertisement by the engineer in a shop dealing in roentgen articles. The film was of the engineer's own foot. He is 24 years old and has on his right foot

an os Vesal. exactly like my first — abovedescribed — case, this thus being the 8th published os Vesal.

(Fig. 16 — 17). The bone is about 16×13 mm, the articular surfaces towards os cuboid. and os metatars. V situated almost right-angled to one another. The fissure between os metat. V and os Vesal. is about $\frac{1}{3}$ cm, a little uneven, the corners rounded. Apart from a doubtful calcan. secund., no accessory bones on the right foot. The left tuber. V is big, no accessory bones on left foot. There has been no trauma on the exterior side of right foot where a prominant tuber. V-part may be seen but otherwise nothing particular. He has never had any pains, but has from childhood been troubled by the prominence when taking off and on his boots.

The following case is kindly placed at my disposal from Professor FISCHER's private institution:

Case 3. Woman 52 years old. Turned over with her bicycle and twisted her foot. The part near tuber. V swelled and gave pains.

(Fig. 18 — 19 — 20). $\frac{20}{10}$ 19. (Some weeks after the injury) roentgen photo: Proximal part of tuber. V separated from the remainings by a straight fissure. The bone-limits towards this are condensed (corticalis). The same foot shows a big os posterior tali and a tibiale extern. Natural tuber. V on left side.

In Sept., 1921, os Vesal. is still clearly seen but apparently about to coalesce with os metatars V.

Case 4. (From Bornholm's county infirmary).

Man 53 years old. His feet never troubled him till March, 1921, when a cow stepped on it. Only slight pain which soon disappeared. At the end of August pains in the lateral side of the foot. The pains increased especially when walking and forced him to give up working. He has always walked on the outer foot on the lateral side of his right foot. Small prominence of the part corresponding to tuber. V, which is sore.

Fig. 21. Roentgen plate shows an os Vesal. $1 \times 1\frac{1}{2}$ cm big, oval, somewhat triangular and lying by the point of tuber. V. No other accessory bones. Normal tub. V. on left side.

At the operation $\frac{7}{11}$ os Vesal. was removed. The bone resembles case No. 1 a great deal. It looks as if there were a joint with joint-space and joint-capsule edge towards tuber. V as well as towards os cuboid. Microscopy (DR. JES. JESSEN): Fibrocartilago on both articular surfaces.

I thank head-surgeon WESSEL and assistant-surgeon EIKEN for their permission to publish case No. 1 and Dr. EIKEN for help during the composition of this article. Professor FR. C. C. HANSEN I thank for his valuable anatomical hints and the zoologist. C. STEENBERG M. A. for assistance with the zoological problems. Furthermore, I am thankful to Professor FISCHER for placing case No. 3 at my disposal as well as to the heads of the hospital departments for having kindly placed the material of the metatarsal fractures at my disposition, and finally I thank Dr. KIRKEBY, RØNNE, for case No. 4.

Additions during the correction:

In the September number of »Arch. of Rad. and Electr.» TH. HOLLAND has treated os Vesal. As DWIGHT he regards the apophysis as the genuine Vesal bone, being his opinion on the finding of apophysis in 6 persons from 11—15 years old. He does not acknowledge other Vesal bones though he knows the works of LAQUERRIÈRE and DREWON.

In the October number, 1921, of »The Am. Journal of Roentgen» A. HOW. FIRIE mentions and shows an os Vesal. very like my case number 3. He does not enter upon theoretical meditations or polemic contemplations.

In my work I have not mentioned an article by FRÖLICH (Nancy) in »Rev. d'Orthop.» 1913. He shows and describes 2 cases of rather a puzzling nature, the text is vague and the pictures are not good. No. 1 is supposed to show an os Vesal. + an apophysis in a 13-years-old girl, only the apophysis can be seen in the picture. No. 2 should show an os Vesal. but the picture is more like the irregular alterations which may be seen as, for example, after a fracture.

Summary

At the proximal extremity of the os metat. V appear two forms with the likeness of epiphyses.

1. The »Apophysis» a frequent perhaps constant shell-formed epiphysis on the latero-plantar part of tuber. V. The ossification of it commences in the tendon of musc. peron. brevis.

2. The proximal part of tuber. V has now and then a certain independence showing a special centre for ossification. Occasionally a terminal form like an epiphysis may be seen, which at autopsy in the 3 cases hitherto examined has proved to be not an epiphysis but an independent bone: Os Vesalianum tarsi.

Tuberositas ossis metat. V corresponds morphologically, phylogenetically and ontologically to the vanished os tarsale V in the distal row, and os Vesal. must be understood as an atavically appearing os tarsale V.

The fact that os Vesal. is so seldom found, though more frequently than was formerly supposed, supports the supposition that os tarsale V disappears at an early stage in the development.

In further agreement with this theory is the fact that an os tarsale V is only found in toads, reptiles, and in the embryonic life of the lowest class of mammals.

The theory is sustained by the mutual position of the bones in the early stages of the human embryonal life.

Now and then as Vesal. and the abovementioned apophysis are mistaken for fracture of tuber V. Several different circumstances in the anamnesis and in the roentgen photos help to make the differential diagnosis.

The usually stated criterion for recognition of the genuine bones — that they are bilateral — cannot be maintained as a necessary claim.

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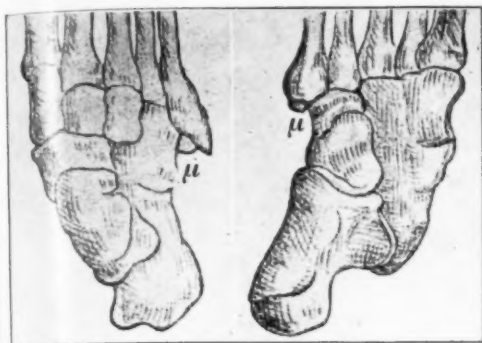


Fig. 1. Vesalius.

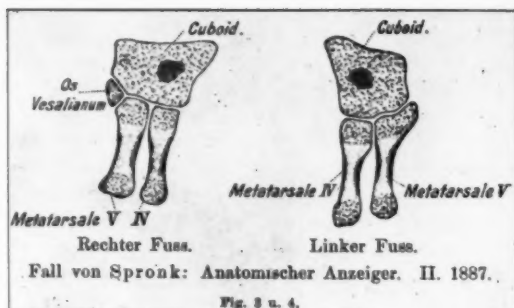


Fig. 2. Spronk.



Fig. 3. Gelinsky.

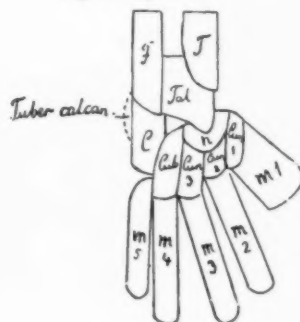


Fig. 4. Schomburg.

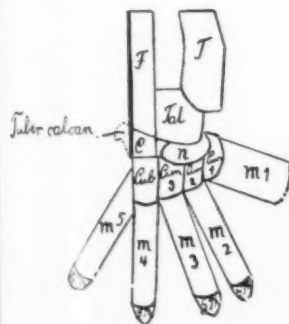


Fig. 5. Schomburg.



Fig. 6. Os Vesal.?



Fig. 7. Os Vesal.?

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Fig. 8. Os Vesal. 2. Fract. tub. V?



Fig. 9. Fract. tub. V.



Fig. 10. Fract. tub. V.



Fig. 11. Fract. tub. V.



Fig. 12. Fract. tub. V.



Fig. 13. Fract. tub. V.



Fig. 14. Os Vesal. 1.



Fig. 15. Os Vesal. 1.



Fig. 16. Os Vesal. 2.

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Fig. 17. Os Vesal. 2.



Fig. 18. Os Vesal. 3.



Fig. 19. Os Vesal. 3.



Fig. 20. Os Vesal. 3.



Fig. 21. Os Vesal. 4.

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Altérations du sang chez les malades traités par les rayons X et par le radium*

par

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Depuis l'époque où l'on commença à faire des recherches plus approfondies concernant l'action des rayons X et du radium sur l'organisme vivant, on a clairement compris que l'appareil hémoplastique était, pour les rayons, l'un des plus sensibles systèmes des organes. Depuis les investigations radicales de Heinecke traitant de l'influence délétère des rayons X sur les globules du sang, l'intérêt au sujet de ces questions a toujours été en augmentant et de nombreuses recherches ont été faites de divers côtés. En éliminant les études expérimentales purement animales, on peut dire que la marche en avant s'est surtout portée sur trois lignes spéciales, d'abord, d'exercer au moyen des rayons X une action sur les altérations pathologiques dans l'appareil sanguin et de détruire ces altérations; comme résultat on eut la thérapie moderne des leucémies; ensuite, par le contrôle du sang, à veiller à ce qu'aucune altération grave ne se produise chez le personnel travaillant dans les laboratoires radiologiques enfin en suivant l'image sanguine chez les malades traités par l'irradiation et à examiner à quel degré des altérations secondaires surgissent dans le sang en connexion avec des irradiations locales. Il est certain que l'intérêt pour ce dernier groupe a considérablement augmenté, suivant en cela l'énorme développement qu'a parcouru la radiothérapie profonde ces dernières années. Par elle on a réussi, tout autrement qu'avant, à atteindre des organes pathologiquement altérés, placés très profondément, mais, en même temps, le risque a augmenté de provoquer, par l'irradiation, diverses altérations secondaires qui peuvent nuire plus ou moins au malade et qui se manifestent surtout dans la composition du sang. Les conceptions des investigations qui ont vu le jour ces derniers temps, ont beaucoup varié, et les inductions tirées des différentes variations des types cellulaires sont loin

* Communication au 2^e congrès de Nordisk förening för medicinsk radiologi à Copenhague, 1921.

d'être unanimes, c'est pourquoi le problème n'est pas près d'être considéré comme résolu.

Durant ces dernières années, j'ai eu l'occasion, à Radiumhemmet à Stockholm, de suivre chaque jour environ 70 cas avec contrôle du sang et j'exposerai ici quelques-uns des résultats auxquels je suis arrivé.

En ce qui concerne les globules rouge, ce domaine paraît être celui où les avis sont le moins en désaccord, mais celui aussi qui, au point de vue clinique, offre le moins d'intérêt, les altérations étant si indistinctes qu'une solution proprement dite, dans un sens ou dans un autre, peut à peine être trouvée. L'opinion générale que j'ai aussi pu vérifier dans mes cas est que, peu après le traitement il y a une légère augmentation d'hémoglobine, ainsi que du nombre des globules sanguines et de la valeur globulaire, augmentation qui persiste ensuite plus ou moins longtemps après le traitement et qui varie beaucoup chez les différents malades. Dans les observations émanant de la clinique d'Erlangen, on trouve une interprétation un peu divergente, en ce sens qu'après des traitements soit faibles, soit forts, on a obtenu une diminution du nombre des globules rouges. On a même essayé d'expliquer théoriquement ce fait, mais cela nous mènerait trop loin d'entrer dans ces détails. Il nous paraît en tous cas inadmissible de tirer des conséquences absolues ou d'être guidé dans notre pronostic par le degré des altérations.

L'image des globules blanches par contre offre un intérêt tout autre. Même après une dose assez minime, on peut, dans les cas non compliqués, constater dans cette image, une réaction accentuée avec une augmentation initiale du nombre des leucocytes, puis du 4^e au 6^e jour une diminution et ensuite un retour au taux original. Ces altérations proviennent surtout des leucocytes polynucléées, tandis que la courbe des lymphocytes reste constante. C'est cette réaction que, dans un grand ouvrage de 1920, Siegel appelle réaction du premier degré, observée après ce qu'on nomme doses de castration, appliquées soit par les rayons X, soit par le radium. Partout ce fait se reproduit que le type de la réaction sanguine est absolument identique, qu'il soit causé par la radiumthérapie ou la radiothérapie, même si le degré varie suivant l'intensité du traitement. Les altérations qui surviennent après un traitement radiologique des tumeurs se placent sur un autre niveau. Comme de juste, la réaction est ici beaucoup plus prononcée par suite de la dose beaucoup plus considérable employée, mais d'un autre côté l'image se complique encore de l'effet toxique, suite naturelle de la dissolution et de la résorption des amas tuméfiés. Ce dernier point de vue ne paraît pas avoir été pris en considération auparavant et les avis extrêmement partagés des divers auteurs, justement à cet égard, me semblent pouvoir parfaitement s'expliquer si l'on accorde plus d'importance à l'effet toxique secondaire

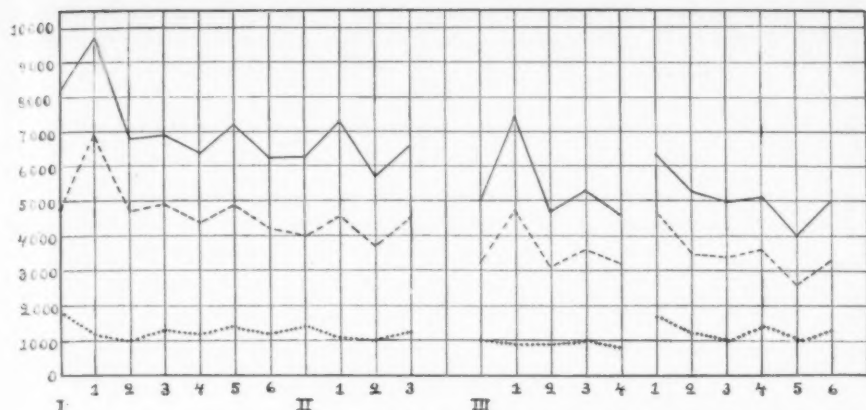


Fig. 1. Cancer de l'utérus avec pronostic favorable. Valeur absolues. — Leucocytes. — — — Neutrophiles polynucléaires. + + + Lymphocytes. Les chiffres suivant immédiatement les chiffres romains désignent les jours; la série des chiffres venant après indique les mois après le traitement.

sans envisager le tout dans son ensemble comme une simple réaction du traitement.

Pour commencer, nous présentons ici une courbe (fig. 1) qui met typiquement en lumière les altérations du sang durant le traitement au radium du cancer de l'utérus. Sur l'abscisse sont placés les jours et les mois après le traitement, sur l'ordonnée le nombre des cellules blanches du sang. Les leucocytes sont indiqués par un trait droit, les neutrophiles nucléés par un trait pointillé et les lymphocytes par un trait de croix. Les chiffres romains désignent le 1^{er}, le 2^e et le 3^e traitement; le second traitement est donné le 7^e jour après le 1^{er} et le 3^e, un mois environ après le 1^{er}. Chaque traitement correspond en moyenne à 2,000 milligrammes-heures de radium-élément et l'irradiation du radium a été intra utérine et vaginale en combinaison. Le premier jour après le traitement l'on remarque une augmentation considérable des leucocytes, ce qui a pour conséquence une augmentation des neutrophiles polynucléés, tandis que la courbe des lymphocytes baisse. Le lendemain déjà une chute importante des leucocytes a lieu sous les chiffres du début et la leucopénie résultante persiste ensuite jusqu'au traitement suivant où se produit alors une réaction ressemblant en principe à celle survenant après le premier traitement, quoique plus faible. La courbe des lymphocytes qui, dès le début, baissa, est depuis restée stationnaire à un chiffre très bas, avec une nouvelle diminution après le second traitement. Le même procédé se répète au troisième traitement et la donnée

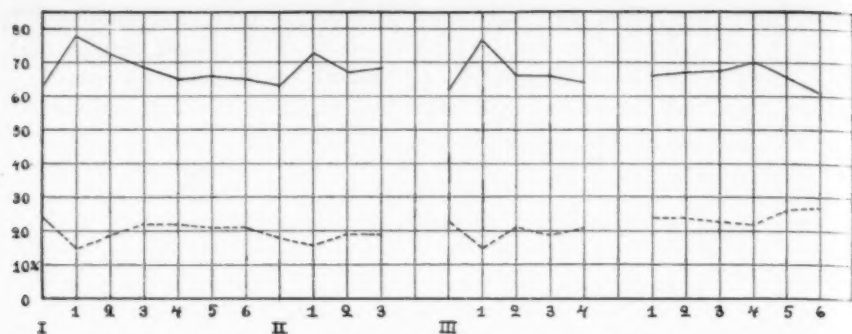


Fig. 2. Cancer de l'utérus avec pronostic favorable. Valeurs relatives. — Neutrophiles polynucléaires. - - - Lymphocytes. Les chiffres sur l'abscisse ont la même signification que dans la courbe précédente.

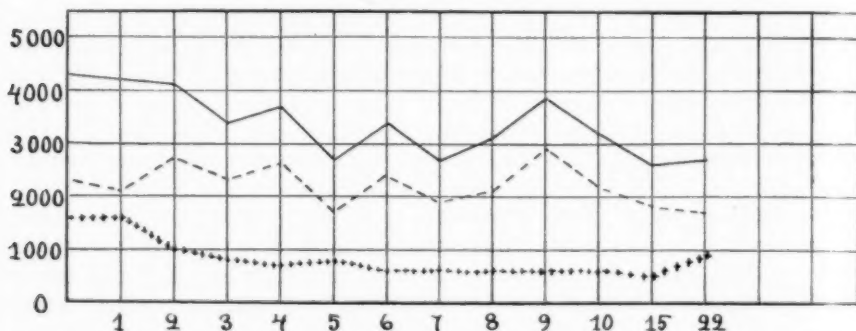


Fig. 3. Cancer mammaire. Valeurs absolues. — Leucocytes. - - - Neutrophiles polynucléaires. + + + Lymphocytes. Les chiffres sur l'abscisse indiquent les jours comptés à partir du début du traitement.

de la courbe est maintenant beaucoup plus élevée, l'organisme ayant recouvré la faculté de réagir plus fortement. Si l'on examine durant les mois subséquents l'image sanguine chez les malades où le traitement radiologique a eu un effet favorable, l'on constate que peu à peu elle prend le type observé généralement chez les individus normaux, donc avec un chiffre plus bas des leucocytes que les chiffres du début qui, lors d'un cas de cancer peu avancé, restent en général au-dessus de la normale. La même chose est démontrée par la courbe (fig. 2) qui indique les valeurs relatives des neutrophiles et des lymphocytes avec le pourcentage marqué sur l'ordonnée. Comme avant, l'on trouve une augmentation initiale des polynucléées et un abaissement des lymphocytes avec un retour relativement prompt aux chiffres originaux, plus précis après le 1^{er} et le 3^e traitement, moins prononcé après le second.

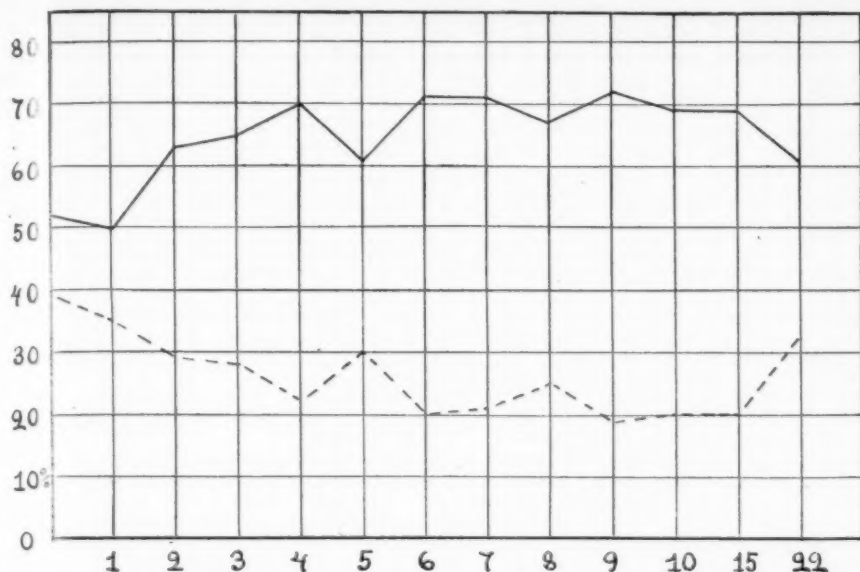


Fig. 4. Cancer mammaire. Valeurs relatives. — Neutrophilies polynucléaires. - - - Lymphocytes. Les chiffres sur l'abscisse ont la même signification que dans la courbe précédente.

Afin de vérifier si la réaction ci-dessus mentionnée provient simplement de l'action des rayons X ou si l'altération sanguine est causée en partie par les effets de résorption des tumeurs diminuant de jour en jour, j'ai examiné une série de cas post-opératoires d'irradiations de cancer mammaire qui furent données, en partie dans un but purement prophylactique, en partie lors de cas où de légères métastases glandulaires s'étaient produites, mais, par suite de leur extrêmement lente résorption, on ne put obtenir d'effet résorbant proprement dit. Pendant une période de 6—10 jours ces malades ont reçu une série de rayons X au cours desquels fut pratiquée une unité de dose cutanée en irradiations sur plusieurs champs de la région d'opération, des groupes sur- et sous-claviculaires se rapportant à l'aisselle et au creux postérieur de l'aisselle, correspondant d'après l'ancienne désignation, à une moyenne de 90—100 H. Ici la réaction a eu un cours différent. (Fig. 3) L'augmentation initiale absolue des leucocytes manque et dès le début a été remplacée par une leucopénie qui embrasse et les neutrophilies et les lymphocytes. Dans la courbe relative, (fig. 4) on rencontre cependant la même tendance que dans le cas précédent, c. a. d. une neutrophilie relative avec une lymphopénie relative fortement accentuée. Il est extrêmement

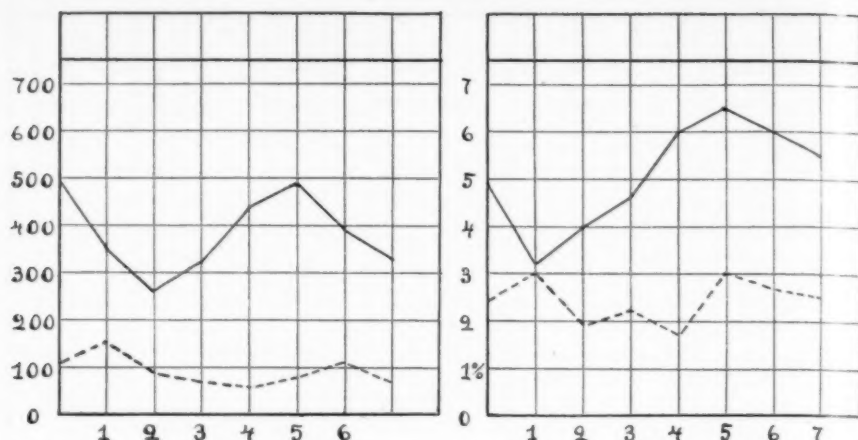


Fig. 5. Cellules éosinophiles. La courbe de gauche correspond aux valeurs absolues, la courbe de droite aux valeurs relatives. Les chiffres sur l'abscisse indiquent les jours après le traitement. — Cancer de l'utérus. - - - Cancer mammaire.

intéressant de suivre dans ces deux types différents les variations éosinophiles de l'image sanguine.

Dans la littérature, les opinions sont partagées quant à l'aspect des éosinophilies après le traitement. Un certain nombre d'auteurs ont trouvé une réduction notable de la courbe des éosinophilies, tandis que d'autres ont aperçu une augmentation considérable du nombre d'éosinophilies. Dans la courbe 5 (fig. 5), on rencontre une reproduction des valeurs éosinophiles de cancers de l'utérus et de cancers mammaires après l'irradiation. Dans les cas postopératoires irradiés, on ne trouve qu'une réaction très minime, plutôt sous forme d'une diminution des valeurs, tandis que lors de cancers de l'utérus se montre une augmentation importante qui est surtout évidente dans la courbe relative (fig. 5) où les valeurs peuvent atteindre à 6 1/2 %. J'ai observé que cette augmentation est en rapport avec une résorption plus ou moins rapide des tumeurs. Chez les malades avec de gros cancers ulcéreux où les conditions d'une résorption rapide sont des plus favorables, les valeurs éosinophiles dans certains cas extrêmes ont dépassé 25 %, tandis que dans les cas de petites tumeurs dures, l'augmentation fut peu considérable. Il semble donc que les altérations dans l'image sanguine éosinophile ne doivent pas être attribuées à une action irradiante primaire mais qu'elles sont une réaction de l'organisme contre l'albumine étrangère résorbée lors de la résorption des tumeurs, réaction analogue à la vieille observation que les malades atteints de tumeurs ont souvent des valeurs éosinophiles dépassant la normale.

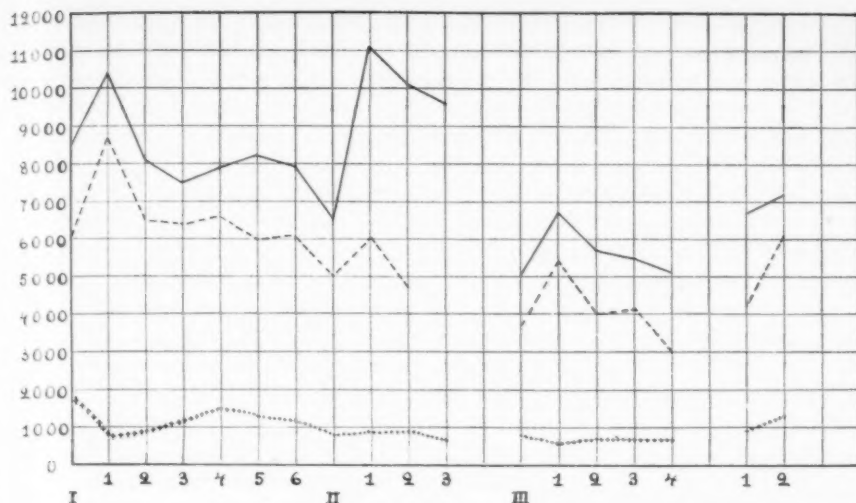


Fig. 6. Cancer de l'utérus avec mauvais pronostic. Valeurs absolues. — Leucocytes. — — — Neutrophiles polynucléaires. + + + Lymphocytes. Les chiffres les plus rapprochés des chiffres romains indiquent les jours, la série des chiffres subséquents désigne les mois après le traitement.

Ce qui offre le plus grand intérêt au point de vue clinique, c'est de savoir comment les altérations sanguines, après le traitement des tumeurs, peuvent servir à poser le pronostic. En partant de ce point de vue, j'ai divisé mes observations du cancer de l'utérus en deux groupes principaux, d'abord les cas où le traitement radiologique a eu un résultat favorable, ensuite ceux où le traitement ne fut suivi que d'une

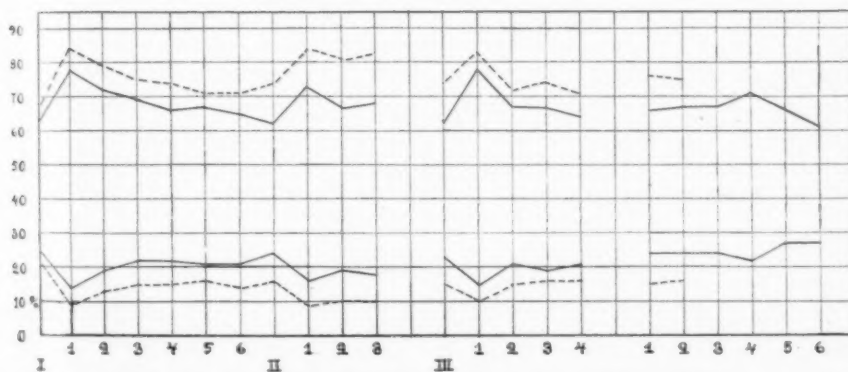


Fig. 7. Cancer de l'utérus. Valeurs relatives. — Cas avec bon pronostic. — — — Cas avec mauvais pronostic. Les chiffres sur l'abscisse ont la même signification que dans la courbe précédente.

amélioration temporaire ou même d'une progression du cancer et cela indépendamment de l'aspect plus ou moins grave du mal au début. La différence dans la réaction sanguine de ces groupes a été frappante. Si l'on compare la première courbe (fig. 1) qui comprend les cas avec un pronostic favorable et une courbe (fig. 6) composée des cas avec pronostic défavorable, on remarque une variation bien plus importante des valeurs sanguines dans le second groupe, ce qui ressort surtout de la courbe (fig. 7) où les valeurs du pourcentage des deux groupes sont inscrites. Il faut observer ici combien le trait pointillé désignant les cas avec un mauvais pronostic s'est déplacée, comparée avec le trait droit et ceci déjà immédiatement après le traitement, même un à deux mois après le dernier traitement, fait encore plus intéressant. Dans les cas favorables, au bout d'un mois déjà, on a constaté un retour des cellules sanguines à des chiffres normaux, tandis que dans les cas de mauvaise nature, cette restauration ne se produisait pas. Ceci dépend principalement d'une incapacité de l'organisme de reconstituer ses éléments lymphocytaires dont les valeurs absolues dans les pires cas varient entre 600 — 900 en contraste avec le groupe bénin aux valeurs correspondantes de 1100—1600, rapport qui devient intéressant à la lumière des nouveaux points de vue qui ont surgi ces dernières années, concernant l'importance des lymphocytes dans la lutte de l'organisme contre les cellules des tumeurs.

Il paraît donc qu'à l'avenir l'examen du sang chez les malades atteints de tumeurs, jouera un rôle transcendant dans les travaux des cliniques radiologiques. Par là, le médecin a trouvé un guide le mettant à même de juger des effets généraux du traitement aux rayons X. et, jusqu'à un certain point, il peut en tirer parti pour ses procédés thérapeutiques, vis à vis desquels il importe, lors des traitements locaux intenses, de ne pas provoquer un affaiblissement général d'où résulte une diminution trop prononcée des forces résistantes du corps. De même, en observant l'image sanguine chez ses malades, le radiologiste, bien des fois, est guidé par elle, lors de situations fréquemment douteuses, lorsqu'il s'agit avec plus ou moins de sûreté de juger des cas en se basant sur le pronostic.

Résumé

L'auteur a étudié les altérations sanguines chez des malades traités par les rayons X et le radium. Dans les deux cas, les altérations sont absolument identiques, variant seulement en force d'après l'intensité de l'irradiation. Les altérations des globules rouges se distinguent par une légère augmentation du nombre d'érythrocytes, dans la quantité

d'hémoglobine et de la valeur globulaire qui se traduisent très différemment chez les divers malades et qui persistent plus ou moins longtemps.

On ne peut tirer aucune déduction certaine de ces altérations; elles ne paraissent pas non plus pouvoir aider à former un pronostic quelconque. Les altérations des globules blanches sont beaucoup plus prononcées. Après de faibles doses, correspondant à peu près à un traitement pour castration, on obtient une augmentation initiale du chiffre de leucocytes causée par les neutrophilies polynucléaires et du 4^e au 6^e jour une chute des leucocytes, ensuite une rétrogradation lente vers les valeurs initiales. Le nombre des lymphocytes reste constant. Les altérations sanguines, après les irradiations de tumeurs, appartiennent à un autre type. Au moyen de courbes, on démontre comment, après des irradiations de radium du cancer utérin, on obtient d'abord une augmentation passagère des leucocytes et ensuite une chute des polynucléaires et des leucocytes. Au bout de plusieurs mois seulement, l'image sanguine est revenue à sa valeur normale. Lors d'irradiations de cancers mammaires après l'opération, là où il n'y a aucun effet toxique secondaire des tumeurs résorbées, l'augmentation initiale des leucocytes n'a pas lieu. Les altérations dans l'image sanguine éosinophile sont attribuées à une action toxique secondaire provenant de la résorption tumescente. Les cas influencés favorablement par le traitement radiologique montrent des altérations sanguines beaucoup moins marquées immédiatement après l'irradiation et une réparation bien plus rapide, surtout des lymphocytes, que pour les cas réfractaires. En conséquence, les examens du sang peuvent servir de guide quant au pronostic.



Treatment of Malignant Tumours with Radium Needles*

by

S. A. Heyerdahl M. D.

One of the many problems which turn up now and again in radium therapy is how and in what manner radium can be most advantageously applied in the treatment of malignant tumours.

Some years ago, when radium was chiefly supplied from the radium factories either as a surface or a tube preparation with the radium salt embedded in a concentrated way, the problem was much more simple. I will here call attention to Dr. EDLINGS's paste as being the only improvement in the external application of radium.

Since then the emanation treatment and the treatment with radium in needles have come out and both methods have justly attracted the attention of radium therapists.

The emanation treatment (with which in this connection I am thinking of treatment with concentrated, purified emanation) has two unquestionable advantages:

1. The expensive radium is not wasted if an emanation tube is lost.
2. The emanation can be melted into tubes or receivers of practically any shape and size, and especially in tubes smaller than those into which the radium salt can be introduced.

On the other hand, the emanation treatment has a few by no means immaterial disadvantages:

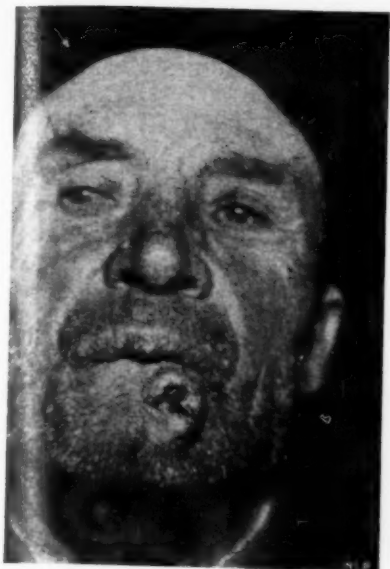
1. To make its use pay, a very great supply of radium (a minimum of 1 gram) is required and a special laboratory and apparatuses for making the emanation are also necessary as well as a skilful physicist to prepare the daily supply.

It is also, of course, a defect that the emanation is not constant, but that its force gradually declines. By means of tables it is, however, easy to calculate the actual activity of the emanation.

The activity of every new emanation tube has always, however, to be measured as soon as it has been prepared; this also requires some time and a separate room distant from the emanation laboratory.

A substitute for the emanation treatment is the application of *radium salt embedded in small hollow needles*, which I have, for practical reasons, called *treatment with radium needles*.

*Read at the II meeting of the Nordisk förening för medicinsk radiologi at Copenhagen. Sept. 1921.



O. P. Photo 1.



O. P. Photo 2.



O. P. Photo 3.

It is particularly among English and American radio-therapeutists that I have seen radium needles applied in tumour therapy.

In the May volume for the year 1921 of the American Journal »Radium» a treatise is reprinted by Dr. WILLIAM L. CLARK: »New conceptions relative to the treatment of malignant disease with special reference to radium in needles», with several excellent, illustrated photographs showing the effectiveness of the treatment with radium needles.

This physician recommends the treatment with radium needles very strongly and he is of the opinion that it will greatly contribute to the extension of the field of radium therapy.

He says that one no longer need give up as quite hopeless malignant tumours in the pylorus, intestines, omentum and other abdominal organs — the larynx, antrum Highmori, orbita etc. These tumours are now accessible to radium therapy.

When radium is inserted (in the form of needles or in some other way) in the tissue of the malignant tumor, it is in the first place evident that the entire activity of the radium applied is utilized in the tissue in this way, while more than half of the radio-activity is dissipated in the air when radium is applied on the outside of tumours, (as surface or tube preparations).

To which it may be added that with the same metal filter the radium may be left longer inside the tumour than outside on the fresh skin or mucous membrane. The tumor itself acts as filter for the rays.

Formerly, when the tumour was large and easily accessible, radium tubes were inserted in the tissue of the tumour upon previous splitting of the tissue by means of a knife or a trocar; this was, however, a method that had a limited field, because the radium tubes were comparatively big and clumsy.

With reference to the radium needles it is quite different. Because of their smallness they are very easily inserted in, so to say, all accessible tumours either direct, without previous splitting of the tissue, or after the insertion of an ordinary syringe.

Local anæsthesia with 2 % novocain — adrenalin is generally applied. General narcosis is seldom necessary.

Against this treatment it has been said that the secondary rays from the metal in the needles will produce necrosis in the tissue.

This will naturally come to pass in the event of the exposure being too long, and the distance between the needles too short or the quantity of radium too large.

The experience from America is that an exposure with radium in needles containing $\frac{1}{2}$ — 1 ctgr. of radium element during 12 to 20 hours will very seldom bring on necrosis in the tissue.

In a general sense Dr. CLARK recommends letting the radium needles lie for 12 hours in the sarcomatous tumour-tissue with a distance of 12 mm. between the needles, and in carcinomatous tissue for 18 to 24 hours, assuming a distance between the needles of 25 mm.

Experience will, however, lead by degrees to a correct judgment.

The treatment with radium needles is to be repeated again if necessary in 6 weeks. (Although, according to Dr. CLARK, one treatment with needles is all what is usually required). The succeeding treatments can in most cases be applied on the outside of the tumour.

At the National Hospital (Rikshospitalet) in Christiania we got our first radium needles in March this year, so it is evident that what I have to say to-day is only of quite a preliminary character.



M. B. Photo 1.



M. B. Photo 2.



M. B. Photo 3.



M. B. Photo 4.

We got from Armet de Lisle in Paris 5 needles, 17 mm. long and 1.3 mm. outside diameter; thickness of the walls 0.3 mm. The needles were of platinum iridium and each needle contained not quite 1 ctgr. of radium (calculated as $\text{Ra. Br}_2 \cdot 2 \text{H}_2\text{O}$) or 0.46 ctgr. radium element.

*

Case 1. O. P.

The case which in the first place attracted my attention and absorbed my interest for a treatment by the new method was a 65-year-old raftsmen who had been operated for labial cancer in October, 1919. At the beginning of July there was a recurrence in the form of a hard tumour on the lower lip, between the skin and the mucous membrane. The tumour increased rapidly and the skin covering became infiltrated and ulcerated.

He was admitted to the Radium Institute on the 27th of August last year (1920). The left half of the lower lip was for the greater part involved, as can be seen from photo 1, by a hard tumour of the size of a walnut, in the centre of which a crater-formed ulcer, the size of a 25-öre piece, covered with yellow blood-stained incrustations, was located. The surroundings of the tumour were strongly affected. From the bottom and the edges of the lesion there emanated an abundant purulent secretion.

The lip was infiltrated through the whole of its thickness, the mucous membrane seemed, however, to be normal.

A hard gland was felt below the left mandible.

This patient was then treated with radium in the ordinary way, with tube preparations on the outside of the tumour from 27th August, 1920, to 13th February, 1921, during 5 sittings, on the average with 10 ctgr. of radium ($\text{Ra. Br}_2 \cdot 2 \text{H}_2\text{O}$) and 1 mm. lead filter at each sitting (20 hours.)

While the gland below the left mandible remained somewhat unchanged during this treatment, the tumour and ulceration on the lower lip grew rapidly after some stagnation, and in the middle of April, 1921, (see photo. 2) it had spread, as shown in the illustration, over the lower lip and over the greater part of the left side of the chin, and it commenced to eat its way into the left cheek. The ulceration was covered with a very foetid pus. It was a miserable picture. The tumour seemed quite insensitive to the radium rays.

In the meantime, however, the radium needles had arrived from Paris and I therefore decided to try the effect of the needles on this patient, which I thought would be a good test. On the 14th of April 5 radium needles were inserted in the vallated concave edges of the ulceration and on the 12th of May again 5 radium needles, so that the whole area around the ulcer had now been treated once for 20 hours with radium needles, the distance between the needles being about 25 mm. Besides this the patient had some radium tubes placed outside of the tumour.

On the 9th of June I saw the patient once more. The whole picture of the tumour had now changed. The ulceration had been purified, the malodour was quite away and the vallated edges had mostly disappeared.

The patient has on 2 subsequent occasions — 21st. July and 7th. September — again had needle treatment of the lesion in both corners of the mouth.

As will be seen from the last picture taken of him on 9/6—21 (see photo 4), the tumour has now practically gone and the ulceration continues to improve, and we have the best hopes of a complete recovery.

Case 2. N. B. The second patient of whom I shall make mention was a farmer, 63 years old, who suffered from a similar recurrence in the lower lip after an ope-



E. B. Photo 1.



E. B. Photo 2.



E. B. Photo 3.

rated labial cancer, although it was not so far advanced as in the first case. When admitted to the Radium Institute on 18th May of this year a good almond-sized, hard, nodulated infiltration was located in and around the cicatrice on the lower lip.

This patient was from the beginning treated with radium needles. 5 needles were inserted in the tumour and taken out after 20 hours' application. Besides 5 ctgr. on the outside of the tumour — 2 mm. lead filter for 8 hours.

This last treatment, however, I ought certainly to have left alone, as a radium-dermatitis developed on the skin as well as on the mucous membrane, which took 4 weeks to heal.

However, the results obtained were ultimately excellent. Complete disappearance of the tumour. (September, 1921).

Case 3. M. B. The third patient was a 67-year-old woman, who was admitted to the Radium Institute on 29th October, 1918, with an advanced epithelioma on the left cheek just below the lower left eyelid (see photo 1).

She was treated with tube preparations on the outside. To begin with 2/10 mm. lead filters and later on 1 mm. during several sittings, with 2 to 3 months' intervals.

Already on 30th November of the same year (1918) the epithelioma had nearly disappeared. (see photo 2). Still quite a small superficial infiltration in the skin in the place of the old ulcer was to be seen up to February, 1921.

Then she stayed away for 4 months from February to June, 1921, on readmission to the institute on 8th June of this year there was a recurrence (see photo 3) in the shape of a big ulceration, the size of a 10 öre piece, with a prominent edge and a purulent bottom.

The outside radium treatment was then abandoned and instead 2 radium needles were inserted in the ulceration. On 9th September the ulceration was healed and the result was a fine and smooth cicatrice. (See photo 4) Not the slightest trace of infiltration or indication of tumour.

Case 4. A man, 77 years old, with tumour on the lower lip was admitted to the Radium Institute on 23rd June. This patient was treated with 2 radium needles in the tumour (20 hours' treatment) and besides this a 5 ctgr. tube with 2 mm. lead filter on the outside.

On 12th September there was only an infiltration, the size of a grain, left on the lower lip.

Treatment with Radium Tubes Embedded in the Tumour

Case 5. A. K. Workman's wife, 55 years old, admitted to the Radium Institute on 21st. January, 1918.

She had been previously operated for carcinoma on the nose, the actual tumour being a recurrence, a hard, knotted tumour on the bridge of the nose, the size of a hazelnut, covered with a thin, atrophic skin (see photo 1).

A tube with 1 ctgr. radium was embedded in the tumour for 20 hours, without filter, besides 7 ctgr. with 1 mm. lead filter on the outside.

About 2 months after this, on 16th March, the tumour on the nose had quite disappeared. No recurrence has since taken place (1921) (see photo 2).

Case 6. E. B. Another patient that has likewise given much satisfaction, on account of the good results with embedment of radium in the tumour, was:

A boy, 8 years old, who was operated just before Christmas 1919 for a sarcoma on the right cheek. It did not, however, last long before a recurrence took place



Photo 1.

A. K. Before radium treatment.

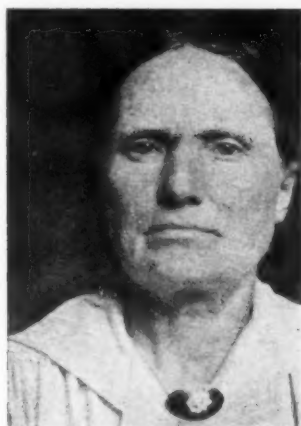


Photo 2.

A. K. After radium treatment.

and he was then admitted to the Radium Institute on 7th February, 1920 (see photo 1.)

This patient, who, when admitted to the Institute, had a tumour, the size of a child's head, on the left cheek and around angulus mandibula, had embedded in the tumour for 20 hours a 5 ctgr. tube without filter and besides this 14 ctgr. with 1 mm. lead filter outside of the tumour. The embedment of the 5 ctgr. tube in the tumour was repeated after 1 month, later only outside radium treatment.

On 12th August the tumour had quite disappeared and a year afterwards in August, 1921, no recurrence had taken place. (See photo 2 and photo 3.)

Summary

The previous favourable results of the treatment of malignant tumours with radium embedded in needles confirm what has also been experienced from other quarters. — Embedded in the tissue of the tumour, the radium exercises throughout a much greater influence on the tumour than when applied on the outside, and it is also much more lenient towards the surrounding healthy tissue.

Tumours which had formerly been treated on the outside with radium, without any result, vanished after the embedment of radium in the tissue of the tumour.

As these observations have been made in rather a short time they must, of course, be considered as quite preliminary.



The Treatment of Myoma Uteri and Menorrhagia with Radium and Roentgen Rays*

by

S. A. Heyerdahl, M. D.

As we now actually stand before the beginning of a new period of roentgen therapy, I thought it would be of interest to take a look round and see what we have hitherto attained through the old methods with reference to *myoma uteri* and *menorrhagia*, in as far as this subject has just been up for discussion at the Scandinavian Surgical Congress in Helsingfors where it was much commented on by the surgeons and gynecologists of these northern countries.

Of the rather numerous cases of myoma and menorrhagia, which I have had the opportunity of treating with rays since 1912, I have collected those which have been dealt with from 1912 to 1919 and which have been under observation for 2 years and more. When I leave out those cases which have only been observed for some short time or have been insufficiently treated with rays, there remain 30 cases of *myoma uteri* and 11 cases of *menorrhagia*, which I have had the opportunity of following from 2 to 9 years.

I shall begin with the *myoma uteri*.

Myoma uteri — 30 patients

Of these patients 17 have been under observation from 5 to 9 years and 7 from 2 to 5 years after beginning the ray treatment.

6 patients have been operated after the ray treatment,

25 patients were only treated with roentgen rays,

5 patients got both roentgen and radium treatment.

The dosage with roentgen rays

The roentgen treatment has been applied in series at intervals from 1 to 2 months. At each of the series, which as a rule have extended

* Read at the II meeting of the Nordisk förening för medicinsk radiologi at Copenhagen. Sept. 1921.

over a period of from 2 to 3 days, $\frac{1}{2}$ to $\frac{3}{4}$ Sabouraud with hard rays has been applied to the abdomen on 4 *different areas*. (2 mm. ampères, 8 to 9 Bauer, 10 Wehnelt) with 3 mm. of aluminium filters, — in other words, what we would now call a comparatively *weak* roentgen treatment.

On the average the number of series has been from 5 to 6, varying from 3 series up to 14 in a single instance. The number of series depending upon the influence of the rays, on the myoma and the menorrhagia.

The dosage with radium

As mentioned above, the radium was applied in 5 cases and as a rule it was introduced in the uterus, filtered with 1 mm. lead and 20 hours exposure. — Dosage from 2 to 4 ctgr. radium ($\text{Ra}_2 \text{Br}_2 2\text{H}_2\text{O}$).

By applying ray treatment the end in view was, in most of the cases, a complete amenorrhoea, and this was also achieved in 23 of them. In one case the roentgen treatment was intentionally interrupted at the moment when *the menstruation had become regular and of normal strength*.

This patient was a married woman, aged 33, that had suffered from an irregular menstruation for several years and who had a myoma uteri the size of a child's head. By treating her with roentgen rays the myoma was extensively reduced, and by-and-by the menstruation became quite regular.

She got her last roentgen treatment in the latter half of the year 1913.

The last diagnosis from her physician is dated $\frac{2}{1}$ 1921, i. e. 7 years after the roentgen treatment. — She was then quite well. — The menstruation was regular and the myoma had been reduced to the size of a clenched fist. (7 series of roentgen treatment from $\frac{7}{5}$ 13 to $\frac{24}{1}$ 14.

6 of the patients that had undergone ray treatment were, as mentioned previously, operated. These cases I shall deal with more particularly, as it is of interest in order to get a just estimate of the value of the application of the ray therapy.

Case I. Was an unmarried woman, aged 47, who had suffered from menorrhagia for years, which had lately led to an *extreme anaemia*. At the beginning of the ray treatment in November, 1914, her bloodcolour value was only 25 %.

Her *myoma uteri* was the size of clenched fist.

On account of the far advanced anæmia an operation was looked upon as dangerous to life, for which reason she was sent to me for ray treatment. — In this case a *combined roentgen and radium treatment was applied*. (9 series of roentgen applications during a period of 4 years from 1914 to 1918, and 3 radium exposures in 1914 and 1915).

The application of this combined roentgen and radium treatment reduced the myoma considerably, until November, 1917, when it grew again to more than the size of a child's head.

During the ray treatment the anæmia disappeared and the general health improved steadily. — On account of the growing myoma and new bleedings the case was operated on $^{10}/_5$ —18. — Submucous myomas were found. After the operation she has been quite well and able to work. With reference to this case I think one must be allowed to say that the ray treatment saved the life of the patient and made a later operation possible. — Repeated radium treatments in the years 1916 and 1917 would possibly have made an operation quite superfluous.

Case 2. Was a married woman, aged 41, that had suffered from severe uterus bleedings and painful menstruations. She was scraped twice without any change for the better. She had a myoma uteri the size of a child's head. — (This patient only got 3 roentgen series $^{25}/_8$ —16 to $^{9}/_{11}$ —16).

The myoma remained unchanged and during the roentgen treatment she had continual regular, partly severe uterus bleedings.

She was operated on $^{24}/_{11}$ —16. Submucous myomas were found. — After the operation she was in good health.

Case 3. Was a married woman, aged 50, that had suffered from irregular, painful menstruations during the last 2 years. — The myoma uteri was as big as a good-sized child's head.

For the first time she had roentgen treatment in 1915 (she had then only 2 series of roentgen treatment). During and after the roentgen treatment the tumour diminished somewhat in size, but the irregular bleedings continued, partly with longer intervals between them. After this she had no treatment for $2\frac{1}{2}$ years. She had ray treatment again in 1918. (6 series from $^{13}/_3$ /18 to $^{16}/_{10}$ /18) which, however, did not appear to have any effect on the myoma but it produced a longer interruption of the menstruation in 1919 and 1920. When she then got bleedings again, and the tumour appeared to grow, an operation was undertaken on $^{18}/_{10}$ /20 and a submucous myoma was found. — After the operation she was quite well.

Case 4. Was an unmarried woman, aged 49, who had suffered from severe menorrhagia. She was scraped in May, 1915, but without any result. Myoma uteri suspected — no palpable tumor.

At the commencement of the roentgen treatment on May 18th, 1916, she was highly anæmic. During the roentgen treatment (4 series from $^{18}/_5$ to $^{12}/_{10}$ /16) the bleedings lessened, but they never quite ceased. — On account of a profuse bleeding she was operated in October, 1916. A submucous myoma hardly the size of a walnut was found when operating in the fundus uteri, protruding into the uterine canal. Later she was in good health.

Case 5. Was an unmarried woman, aged 35 years, who had suffered from painful menstrual bleedings for some years.

An enlarged myomatous uterus was found.

The patient had 9 series of roentgen treatment in 1916 (from $^{11}/_1$ /16 to $^{6}/_1$ /17). The myoma was reduced during the ray treatment and the menstrual bleedings became less painful, but a year after the beginning of the roentgen treatment, they were still rather excessive. She was operated at the beginning of 1917.

Case 6. Was an unmarried woman, aged 47, who had suffered from menorrhagia for several years — partly through severe bleedings together with pains. — When commencing the roentgen treatment in 1916 she was highly anæmic. — A myomatous uterus. She got 6 series of roentgen treatment (from $^{21}/_9$ /16 to $^{25}/_4$ /17). During the roentgen treatment the anæmia disappeared and the bleedings almost ceased. Then once again severe bleedings at the end of April, 1921. She was operated on $^{30}/_6$ /21. Later she was quite well.

From the notes referred to it is quite evident that the roentgen doses (eventually the radium ones) have been too small in all 6 cases. Only with reference to no. 2 no favourable effect of the ray treatment was noticed, but then this patient only got 3 roentgen series.

In case 1 with the extreme anæmia — and possibly also in the other cases — a continuous strong roentgen + radium ray treatment would no doubt have made an operation superfluous.

With regard to the other cases of myoma uteri treated with rays — 24 in all or 80 % — the effect of the treatment was quite satisfactory.

The principal indication for treatment of all these cases was the excessive menorrhagia. After a shorter or longer period complete cessation of the menses followed except in case 1 (the one previously mentioned where a normal menstruation was intentionally brought about).

In 10 cases the myoma quite disappeared or at any rate it could not be palpated. In 9 of the cases the myoma had diminished considerably in size and as to the remaining 5 cases some decrease of the myoma was observed. In 4 of the cases a combined roentgen and radium treatment was applied, the effect of which was that the myoma disappeared altogether in 2 of the cases, and diminished considerably in the other 2 cases; cessation of the menses followed in all 4 cases.

Combined roentgen and radium treatment

In case 1. Cessation of the menses followed after the application of the radium, as the roentgen treatment with which the ray treatment commenced partly seemed to fail (5 series of roentgen from $14\frac{1}{2}/13$ to $18\frac{1}{2}/13$. 3 radium exposures in January, May and June, 1914).

Cessation of the menses one year after the termination of the roentgen treatment. The final result was complete cessation of the menses and disappearance of the tumour.

In case 2. Cessation of the menses, but only after the application of radium. The roentgen treatment had only a passing effect.

In case 3. The roentgen and radium treatment was applied simultaneously and with excellent result — cessation of the menses and disappearance of the tumour. Later on quite well.

In case 4. The roentgen and radium treatment was applied simultaneously (only 1 roentgen serie, 4 radium series) resulting in: amenorrhagia and considerable decrease of the tumour, which was of a good-sized child's head before the treatment, and which attained one finger's breath above the umbilicus (1 year after the treatment the tumour attained 2 fingers' breath below the umbilicus).

There was a great difference in *the size of the myoma* — in the case of these 30 patients. In one case the myoma attained 2 fingers' breadth above the umbilicus, in 3 cases it reached the umbilicus; in 5 cases it has been stated that the myoma was of the size of a child's head, in 1 case the size of a cocoa-nut, in 2 cases just between the umbilicus and the symphysis. The other myomas were small — partly multiples.

When to conclude with I now try to sum up the abovementioned ray treatment of the myoma uteri and the results achieved by this form of treatment, I will then say:

1. A cure was obtained in 25 cases exclusively by ray treatment, in 5 cases through operation and in 1 case through a combination of ray treatment and operation.

2. It has been proved that the roentgen dosage applied has in many cases been too weak. In 5 cases it had to be supplemented by radium rays in order to obtain a satisfactory result, and in 6 cases an operation was necessary as the ray treatment failed totally or partly.

3. In all the cases where radium was applied in addition to the ray treatment the effect has been very good. A combination of roentgen rays and radium thus seems to be a good suggestion, provided it is less convenient to apply the modern, powerful roentgen deep therapy, or there is no opportunity of doing so.

4. In none of the cases have the roentgen or the radium rays had a pernicious effect on the skin in the form of dermatitis or ulceration, or on the internal organs. This I think is worthy of note, when we are now about to occupy ourselves with the new unknown — which we call the modern roentgen deep therapy of myoma uteri and menorrhagia.

5. The usual declining symptoms as heat-strokes and perspirations have occurred, but not to any extent in most of the cases.

Menorrhagia

Of the 20 cases of menorrhagia which I have had the opportunity of treating with roentgen rays, I have later on received particulars about 13, the remaining 7 have not been heard of or have been under observation for too short a time.

Of these 13 patients 5 were between 40 and 45, 5 between 45 and 50 and 3 more than 50 years of age.

2 patients have only been observed for twelve months. The other 11 patients from 2 to 6 years (1 patient for 2 years, 3 for 3 years, 4 for 4 years, 2 for 5 years and 1 for 6 years).

All these patients have only been given roentgen treatment, and in

the same doses as the myoma patients — however, proportionally fewer series — on the average 4 — whereas the myoma patients were given on an average from 5 to 6 series.

In all the cases except one there was a cessation of the menses — and a complete cure. Only with reference to one case was a pernicious affection observed after the roentgen treatment, appearing as a protracted diarrhoea, which, however, ceased by-and-by and at last disappeared.

One of these patients was later operated — in November, 1915 — by scraping on account of violent bleedings. In January, 1917, no bleedings.

Summary

Of 30 patients suffering from myoma uteri 25 were exclusively treated with roentgen rays, and 5 were given combined roentgen and radium treatment.

In 25 cases a good result was obtained: — cessation of the menses together with complete or partial disappearance of myoma in most cases. 5 patients were operated after the roentgen treatment. Of 13 patients suffering from menorrhagia 12 cases attained to a complete cessation of the menses. In one case there was a recurrence and later on an operation.



Some Technical Arrangements in Roentgen Diagnoses and Therapy

by

Prof. J. F. Fischer & Chr. I. Baastrup, M. D.

(both of Copenhagen.)

The following is a description of some smaller arrangements, simplifying the apparatus used in roentgen diagnosis.

For several years these instruments or arrangements have been used in »The Municipal Hospitals of Copenhagen», and may already be known and used in some places, but no publication of them has as yet been made from our hands.

A. Fischer's Hanging Roentgenoscope

This apparatus is designed for roentgenography and fluoroscopy, working with a fixed target-plate distance.

The great advantage in using this apparatus is that it takes up but little space and when not in use may be pulled out of the way, close up to the ceiling of the room.

It is furthermore so simple in construction that no part of it can get out of working order, and, last but not least, it is cheap.

By the addition of some smaller parts it may easily be used in orthodiagraphy.

Regarding technical details, the following may be mentioned as given by the engineers & distributors:

Messrs Levring & Larsen of Copenhagen:

»When using ordinary gas tubes, the target-plate distance is 900 millimeters.

The tube is placed in a special holder in a box opaque to light rays and so arranged that the tube may be easily shifted; the tubeholder may be centered by means of two screws. In front of the tube is placed a shutter.



Fig. 1.

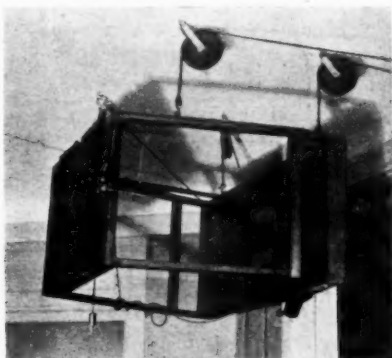


Fig. 2.

The design of this permits of a variable opening either square or rectangular, the control being through duplex levers, which terminate in a single control arm in the front of the apparatus.

These levers operate singly or in union, depending on the opening desired. The front and back of the whole apparatus is covered with lead.

A special arrangement permits of the use of different sizes of fluoroscopic screens, corresponding in size to the cassette to be used.

Usually the roentgenoscope hangs in two reels, but in very low rooms (less than 2.5 meter high), four reels must be used. The roentgenoscope is balanced by means of counterweights which may easily be placed in the corners of the room.

For the arrangements described see Figs. 1 and 2.

B. Standard Tube-holder

The tube lies, as shown in Fig. 3, in a wooden ring.

If the focus on the anticathode is centered right in the bulb, it may easily be seen that the focus is centered right in the middle of the ring too. For the usual gas tubes it has been proved in practice that this way of centering is approximately correct. The ring is fixed to a piece of cardboard with a square cut out in the center.

Baastrup has suggested placing these tube-holders with tubes in each and every one of the tube-stands to be found all over the clinic, and all of them so arranged that, in the tube boxes, some clamps are fixed, under which the cardboard slides along and when in the right place a spring holds the cardboard in position.

As soon as the clinic gets a new tube, it is placed in a tube-holder and remains there as long as it is in working order.

The tube has in this way a good base when standing on a shelf so that no other arrangements are necessary for storing the tubes; in this way there is very little chance of their being destroyed. Tubes are very easily and quickly changed and the system is cheap.

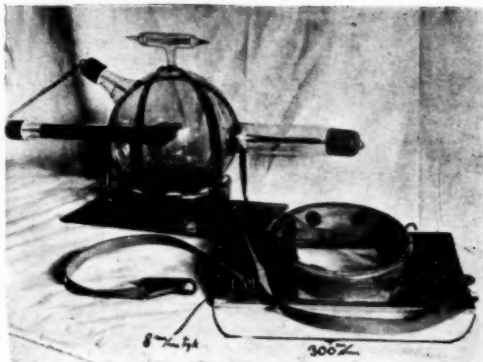


Fig. 3.

C. Arrangements for avoiding mistakes in filtration in deep therapy (by C. J. Baastrup)

From the overhead system in the treatment room there are two connectors supplying current to every tube.

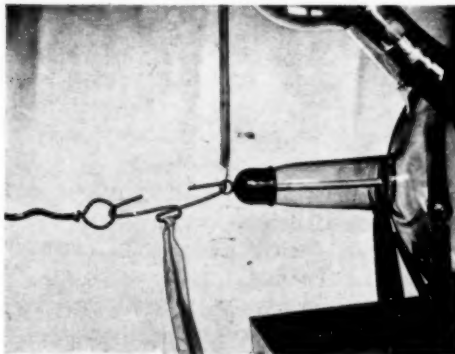


Fig. 4.

One of the connectors usually ends in a hook and is placed directly to the cathode.

The other connector ends in a ring.

This connector cannot be directly connected to the anticathode.

To make connection possible a little double-hook is placed between the two rings, one on the overhead connector, the other on the tube.

The abovementioned double-hook is by means of different kinds and colours of silk ribbons fixed to different filters.

Every filter has its own composition of colours, so that everyone who knows the code can see even from a distance what filter is used.

This safety-guard works exceedingly well and is easy to make. Anyone can arrange it by means of the silk ribbons and a piece of copperwire.

A Device for Providing Protection against Light at the Entrance to the Dark Room at the Roentgen Institute.

by

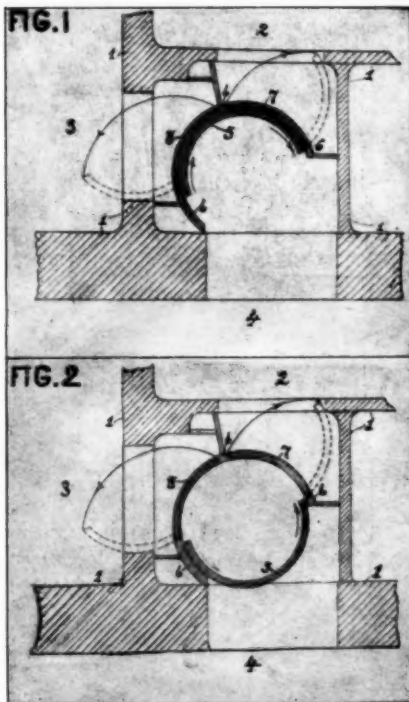
Lars Edling, M. D. (Lund)

Especially in large roentgen institutes where there is a big staff, and where radiography is carried on simultaneously in several rooms, difficulties are frequently encountered in arranging the passage to the dark room by means of the usual double doors (so-called light-lock) in such a way that a meeting in these doorways between in- and out-going persons be avoided and the admittance of unnecessary light into the dark room excluded. It has been sought to obviate these difficulties by the installation of the well-known, so-called »labyrinths» which consist of a zig-zag entrance between walls, projecting beyond each other from opposite sides; but this arrangement generally takes up considerable space.

This is an inconvenience which is urgently felt at the Lund Hospital, as the dark room there is divided into two compartments, the one for development and fixation, the other for washing and examining plates. Both rooms are connected by a sliding shutter in the wall through which the plates pass to the washing tank. Consequently the light can enter the developing room through the doors from the corridor and the washing room as well as through the shutter, which may happen many times daily when one or two doors are opened simultaneously. Space does not allow of a labyrinth entrance.

After one or two devices for doors had for various reasons been rejected, I had the opportunity of consulting a master-builder resident in Lund, L. Larsson by name, constructor of the so-called revolving doors, who solved the problem in what appeared to me to be a very satisfactory fashion.

The door is built in the form of a half cylinder (5 on adjoining figs.), revolving round a vertical centre axis by means of a horizontal



Explanation of Figures:

- 1, walls. 2, washing room. 3, developing room.
4, corridor. 5, revolving door. 6, outer fixed
half cylinder. 7, 8, spring doors.

ball-bearing to be found at the top. It works concentrically with and inside another permanently fixed half cylinder (6) in which there are 2 doors (7 & 8) furnished with a spring closing-mechanism which allows of passage into either dark room but not to both at the same time. By means of light-tight material between both cylinder halves, the light is prevented from entering through joints and cracks. When the movable half cylinder stands in the position indicated by fig. 1, then both dark rooms are shut off and remain so until it is rotated back in the position shown in fig. 2. From the inside of the dark room this takes place by means of specially constructed sliding door-handles. Passage can now take place from the cylinder to either dark room and vice versa. The position of the revolving door on different occasions is announced in the dark rooms by a red light-signal which is let in in the partition between both door openings (at 6).

The revolving door has acted to our perfect satisfaction.
The device is patented by the constructor.

